REPORT

OF

THE REVIEWING COMMITTEE

ON THE

INDIAN INSTITUTE OF TECHNOLOGY

KHARAGPUR

1959

MINISTRY OF SCIENTIFIC RESEARCH AND CULTURAL AFFAIRS
GOVERNMENT OF INDIA
NEW DELHI

PUBLICATION No. 73
MINISTRY OF S.R. & C.A.

PRINTED IN INDIA BY THE GENERAL MANAGER,
GOVERNMENT OF INDIA PRESS, NEW DELHI, 1961

Price Rs. 3·00

CONTENTS

PAGES

Chairman's letter to the President of India . . . . *i*

SECTION I 1—3

Constitution of the Reviewing Committee and Terms of Reference

An outline of the procedure of work and programme of the Committee

Summary of the Committee's Recommendations (Paragraphs 1—10)

SECTION II 4—9

Brief History and Present State of Development of the Institute (Paragraphs 11—29)

SECTION III 10—14

The Trends and Needs of Technological Development (Paragraphs 30—49)

SECTION IV 15—19

The place of the Institution in the educational structure of India (Paragraphs 50—65)

SECTION V 20—23

The number of students and related questions Paragraphs 66—83)

SECTION VI 24—26

Campus Amenities (Paragraphs 84—93)

SECTION VII 27—28

Staff, and Staff-Student Relations (Paragraphs 94—98)

SECTION VIII 29—76

Departments (Paragraphs 99—123)

SECTION X 77—98

Appendices

Chairman's Letter to the President of India

New Delhi, 29 January 1959

From

Sir Willis Jackson, F.R.S.,
Director of Research and Education,
Metropolitan Vickers Electrical Co.,
Manchester, England;
(Chairman, Reviewing Committee,
Indian Institute of Technology, Kharagpur)

To

The President of India,
New Delhi

Mr. President,

I have the honour to forward herewith the report of the Reviewing Committee appointed in terms of the Ministry of Scientific Research and Cultural Affairs, Government of India Notification No. F.20-61/58-T.6, dated the 24th November, 1959, to review the work and progress of the Indian Institute of Technology, Kharagpur since its inception in 1951.

I have the honour to be,
Mr. President,
Your obedient servant,
Willis Jackson
Chairman

SECTION 1

Constitution of the Reviewing Committee and Terms of Reference
An outline of the procedure of work and programme of the Committee
Summary of the Committee's Recommendations

1. We, the members of the Reviewing Committee of the Indian Institute of Technology, Kharagpur, have the honour to submit our report.

2. The Committee was appointed by the President of India in his capacity as Visitor of the Indian Institute of Technology, Kharagpur in exercise of the powers vested in him under Sub-section (2) of Section 9 of the Indian Institute of Technology (Kharagpur) Act, 1956 (51 of 1956). The Committee consisted of the following: —

Chairman

Sir Willis Jackson, F.R.S., Director of Research and Education, Metropolitan-Vickers Electrical Company, Manchester, United Kingdom

Members

1. Professor M. Mujeeb, Vice-Chancellor, Jamia Millia Islamia, New Delhi
2. Shri D. L. Deshpande, Director of Technical Education, Bihar State, Sindri
3. Dr. Atma Ram, Director, Central Glass and Ceramic Research Institute, Calcutta
4. Shri S. Ratnam, Formerly Finance Secretary, Government of India, New Delhi

Secretary

5. Shri G. N. Vaswani, Assistant Educational Adviser (Technical), Government of India, Ministry of Scientific Research and Cultural Affairs, New Delhi

3. The terms of reference of the Committee were to review the work and progress of the Institute since its inception in 1951, and to make recommendations in regard to the further development of the Institute.

4. The Committee assembled at the Institute on the 12th January, 1959, stayed at Kharagpur till the 20th January and then left for further meetings in Delhi. During this period they visited each of the teaching Departments and also the Central Workshops, the Library, the Hospital, the two Staff Clubs and the six Students' Halls. In addition, they held meetings with the Director and the Academic Council, and also with groups of representatives drawn from (a) the

Professors, (b) the Assistant Professors, Lecturers and Assistant Lectures, (c) the Administrative, (d) the Ministerial and (e) the Technical staffs, (f) the Class IV employees, (g) the Students' Gymkhana, (h) the Wardens of the Students' Halls and (i) the Student Officers of these Halls. They also had discussions with several individuals, and frequent meetings among themselves.

The programme of the various visits and meetings is given in Appendix I.

5. The work of the Committee was greatly assisted and facilitated by a series of excellent notes prepared by the Director, by reports from the Heads of Departments and by memoranda submitted for their consideration by the staff and student representatives referred to above. These are detailed in Appendix II. They provided a most helpful background to the visits and discussion meetings and the Committee are most grateful for this material.

6. The Committee also had available in confidence many replies received from some members of the Board of Governors, the Advisory Committees and ex-students of the Institute to letters addressed to them by the Director inviting them to send to the Secretary their views on the work and future development of the Institute.

7. The Committee wish to express their gratitude to the Director for the kind hospitality which he extended to them throughout their stay at the institute, for the courteous way in which he responded to their requests for information and for the thoroughness with which the programme was organised.

8. They also wish to extend their very sincere thanks to all those members of the staff and student bodies who assisted them during their visits and discussions, and for the objective manner in which they made their representations and responded to the many questions asked of them. The Committee were impressed by the quality of these representatives. No doubt there are many others of similar quality whom they were unable to meet.

9. Finally, they would like to express their indebtedness to their Secretary, Shri G. N. Vaswani for the excellence of the preparations which he made for their deliberations and for the compiling of this Report, and to Professor F. R. Perry, a colleague of the Chairman now attached to the Indian Institute of Science, Bangalore under the Colombo Plan, who was of great assistance to them.

10. SUMMARY OF COMMITTEE'S RECOMMENDATIONS

For facility of reference, the Committee are summarising below their major recommendations:—

(i) Progress in technology nowadays involves the collaborative, team effort of groups of scientists and technologists. It is imperative, therefore, that the education of technologists should embrace an advanced and broad-based study of the fundamental sciences in appropriate relationship to the particular technology in which the individual specialises. In developing this point, the Committee draw a clear distinction between the 'technologist' and the 'engineering technician' as these terms are understood in the United Kingdom (Section III)

(ii) The purpose of the Indian Institute of Technology, Kharagpur, is to produce technologists of high calibre in the foregoing sense. The attainment of this objective will call for radical changes in the character of the undergraduate courses at the Institute. With this and other considerations in mind, the Committee recommend a reduced intake of undergraduate students.

The Committee are disappointed with the smallness of the post-graduate population in the technological departments and also in the fact that too few of the present post-graduate students have had prior industrial or similar experience. They consider 12 months external experience of this kind a minimum pre-requisite for post-graduate entry (Section IV).

(iii) The Committee suggest what in their view should be the maximum intake to the several undergraduate technologies and on the extent of the financial assistance that should be made available to the entrants (Section V).

(iv) The Committee indicate the directions in which improvements should be effected in the campus amenities (Section VI).

(v) The Committee suggest certain measures which in their opinion would improve staff and staff-student relations (Section VII).

(vi) The Committee review and make certain recommendations about the work of the departments, and in the introduction to this section they comment on the system of examinations obtaining at the Institute (Section VIII).

(vii) The Committee recommend that the Institute be allowed a revolving advance of about Rs. 10 lakhs to enable payments to be made during the opening months of the financial year before Government grants are received (Section II).

WILLIS JACKSON
M. MUJEEB
D. L. DESHPANDE
ATMA RAM
S. RATNAM

SECTION II

Brief History and Present State of Development of the Institute

11. The Indian Institute of Technology, Kharagpur, is the first of four Higher Technological Institutions to be established in pursuance of the recommendations made by the Sarkar Committee in 1945. These Institutes, it was proposed, should provide undergraduate courses in appropriate subjects of a standard not lower than that of the best technological institutions abroad. They were also to provide facilities for a wide range of post-graduate study and research. The desirable proportion of undergraduate to post-graduate students was envisaged as 2 to 1, with each of the Institutes ultimately having a total student population of some 3,000.

12. The Government of West Bengal made available to the Central Government, free of cost, an area of about 1,400 acres of land at Hijli near Kharagpur about 75 miles from Calcutta, together with a number of existing buildings. The planning of the work on the Institute commenced in May, 1950, and the first batch of undergraduate students was admitted in July, 1951. The Institute now comprises 15 teaching departments and accommodates 1,621 students drawn from all over India. Of this number, 1,446 are undergraduate and 175 post-graduate students and research scholars.

13. The Institute was at first administered by the Government of India through a Board of Governors, but was subsequently incorporated as an Institution of National Importance by an Act of Parliament entitled "The Indian Institute of Technology (Kharagpur) Act of 1956". This Act took effect on the 1st April, 1957.

The Central Government, out of monies provided by the Parliament for the purpose, pays to the Institute in each financial year such sums of money and in such manner as it may think fit in order to enable the Institute to discharge the functions assigned to it under the Act.

14. The late Dr. J. C. Ghosh was the first Director of the Institute. He was succeeded by the present Director Dr. S. R. Sen Gupta in 1954.

15. The Board of Governors is the supreme body of the Institute. Its constitution and present membership are given in Appendix III.

16. The Academic Council is responsible for the laying down and maintenance of the standards of teaching and examination. It performs the duties and exercises the powers vested in it by the Act and the Statutes, and advises the Board of Governors on all academic matters. The constitution of the Academic Council is given in Appendix IV.

17. The Academic Council has appointed an Advisory Committee for each of the 15 departments. These Committees are composed of eminent educationalists, scientists and industrialists drawn from

the appropriate fields and assist the departments in planning their development.

18. Table 1 of Appendix V gives the date on which each of the 15 departments of the Institute was started, the date of commencement of its undergraduate course, the degree awarded and the present sanctioned annual intake of undergraduate students.

19. *Post-Graduate Courses*: At present 13 departments of the Institute are together conducting 35 post-graduate degree courses and two post-graduate diploma courses. Table II, Appendix V shows the subjects of these courses, the year of their commencement, their duration, the annual intake capacity, the students at present enrolled and the previous output.

20. *The Student Body*: Table III of Appendix V gives full details of the increase in the number of students, undergraduates, post-graduates, research scholars and post-doctorate fellows from 1951-52 to 1958-59. The corresponding figures for the end of the same sessions are given in Table IV, Appendix V.

Table V shows the sub-division of the undergraduates among the various departments, according to the courses taken.

The number of undergraduate candidates successful in the final examinations, the courses taken by them and their year of graduation are given in Table VI. This Table also shows the proportion of those obtaining the first and second classes in each course.

Table VII gives an analysis on similar lines of the 242 students who have been awarded the M. Tech. degree, and Table VIII the number of research scholarships and post-doctoral fellowships which have been sanctioned for the various departments, and the number actually admitted as on 6th January, 1959.

Table IX gives the field of investigation of the research students and the year in which the Ph D. degree was awarded to them.

21. *The Institute Staff*: The staff of the Institute is broadly divided into four categories, namely, academic, administrative, technical and supporting staff (including class IV staff).

The total number of posts sanctioned for the Institute is 1,222 comprising—

(*a*) Academic staff . . .	356
(*b*) Administrative staff . .	7
(*c*) Technical staff . . .	282
(*d*) Supporting staff . . .	577 (including 364 class IV staff).

The 356 academic posts sanctioned include the Director, the Deputy Director, the Librarian, one Senior Scientific Officer, 32 Senior Research Assistants and 18 Junior Research Assistants. In computing the student-teacher ratio, these posts have been excluded and six Senior Research Assistants have been equated to one full-time teacher. The total teaching staff is therefore equivalent to 307.

backward classes so that in due course the general level of education throughout may be raised.* The standard for graduation should be not lower than that at a first class institution abroad for example B.Sc. (Tech.) of Manchester or B.S. of the Massachusetts Institute of Technology.

20. It is not possible to lay down any definite length for the post-graduate course. It may normally be of 1 or 2 years' duration though in the case of certain subjects and of students aspiring to higher degrees after research, it may be considerably longer.

21. The proportion of under-graduate to post-graduate students should be 2 : 1.

22. The subjects in which courses should be provided at each stage should be determined individually for each Higher Technical Institution in relation to ascertained needs and in the light of the considerations set out in paragraph 6. As an indication of what they have in mind the Committee have worked out in some detail the under-graduate basic courses which they think should be provided at the Eastern and the Western Higher Technical Institutions and the approximate number of students for which provision should be made in the Eastern Institution at the under-graduate stage. The results, which should be regarded as provisional, are set out below.

XI.—THE EASTERN OR CALCUTTA INSTITUTION

23. *Location.*

For reasons explained in paragraph 8 the Eastern Institution should be located as near Calcutta as possible, say within a radius of 20 miles, and preferably on the Hooghly.

24. *Scope and Size.*

(*i*) *Basic Under-graduate Courses.*—The approximate number of successful students to be turned out annually is shown in brackets against each subject :—

Aeronautical Engineering	(40)
Chemical Engineering	(60)
Civil and Sanitary Engineering	(40)
Electrical Engineering	(60)
Mechanical Engineering	(60)
Architecture (Building construction & Town Planning)	(60)
Metallurgy	(20)
Botany	(10)
Meteorology	(10)
Geology and Geophysics	(20)

*Industrial Administration, Industrial Hygiene and Economics.

Humanities.

*Mathematics and Statistics.

*Chemistry.

*Physics.

(*ii*) Administration should take care of physical welfare of students and maintain industrial co-operation.

(*ii*) *Post-graduate Courses.*—The numbers in each subject cannot be fixed at this stage though the total number should be roughly half the under-graduate enrolment. It is not contemplated that Post-graduate students will be recruited

---

†Note.—This is only a tentative view not unanimously subscribed to by the members of the Committee and will receive further consideration.

*It is not proposed to provide instruction leading upto a special degree in the subject.

exclusively from those who have graduated from the Higher Technical Institutions. Places should be available for suitably qualified graduates from other institution both in the region and outside. Courses to be provided are :—

Fuel Engineering or Technology.
Pharmaceuticals and Fine Chemicals.
Regional Planning.
Paper Technology.
Glass and Ceramics (in co-operation with the proposed Glass and Ceramics Institute).
Plastics.
Paints and Pigments.
Hydraulic and River Research.
Transportation (including Railway Engineering).
Structural Engineering (including High Dams).
Design of Electrical Machinery.
Refrigeration and Air-conditioning.
Automobile Engineering.
Machine Tools.
Design of machinery and Instruments.
Lightalloys.
Industrial Physics.
Electronics (including radio engineering).
Economic Botany.
Geophysics, Geology, Mineralogy.
Meteorology.
Food Technology.

(Post-graduate training in Aeronautical Engineering to be given in the Indian Institute of Science, Bangalore and/or abroad.)

(*iv*) *Size of the Institution.*—With a four year course, the effective number of under-graduates ought to be 1916. To allow for wastage and future expansions plan should be drawn for an under-graduate student body of 2000 and for 1000 seat in post-graduate departments.

XII.—THE WESTERN OR BOMBAY INSTITUTION.

25. *Location.*

The institution should be located near Bombay.

26. *Scope.*

(*i*) *Basic Under-graduate Courses.*—At the Bombay Institution the Basic courses to be provided are :—

Building construction and architecture.
Chemical Engineering.
Civil and Sanitary Engineering.
Electrical Engineering.
Geology and Geophysics.
Mechanical Engineering.
Textile Technology (including Designing).

per cent. When the C.P.W.D. responsibility is taken over by the Institute, these departmental charges will cease, but the whole cost of the staff of the engineering unit will fall on the Institute.

The details of the number of staff in each category entitled to the various types of quarters, the approximate area of each type, number of existing quarters (old and new), number of quarters sanctioned but not yet constructed and the additional number of quarters required are given in Table XIII, Appendix V.

25. *Students' Halls* (*Item* 3, *Table XI*): There are at present six Halls—three accommodating 300 students each, two accommodating 350 each and one accommodating 100 students. These six Halls have been constructed at a cost of about Rs. 62·55 lakhs.

Another Hall for 100 students is under construction and is nearly complete. It will be occupied by students towards the beginning of the next session. This new Hall is estimated to cost about Rs. 5·5 lakhs. The total cost of the seven Halls amounts, therefore, to Rs. 68·05 lakhs.

The Institute will thus have seven Halls for 1,800 students as against a sanctioned enrolment of 1,948 and an existing enrolment of 1,621. The Institute has now requested for two more Halls—one for 200 undergraduate students, and the other for 50 persons attending a variety of short-term courses to be organised from time to time. The estimated cost of these Hostels is Rs. 13·00 lakhs.

26. *Services and Amenities*: (*Item No.* 4, *Table XI*): Table XIV Appendix V details the purposes for which the expenditure on Services and Amenities has been incurred and those for which further expenditure has been sanctioned, and is now requested.

27. *Equipment and Recurring Expenditure*: The expenditure of the Institute on equipment, furniture and fittings up to the end of 1957-58 session is about Rs. 169·78 lakhs of which about Rs. 28 lakhs was provided under the Technical Cooperation Mission and the Colombo Plans. The estimated further expenditure on these items up to the end of the second Plan period in the 1960-61 session amounts to some Rs. 50·23 lakhs of which equipment valued at about Rs. 20 lakhs will be supplied by Technical Cooperation Mission.

The recurring expenditure may be broadly sub-divided into the following categories:

(a) Staff Salaries and wages.
(b) Allowances, Honoraria etc.
(c) Departmental Operating Costs.
(d) Scholarships, Fellowships and Examination charges etc.
(e) Pensions.
(f) Maintenance of buildings, electricity and water supplies etc.

The total expenditure under these heads up to the end of the 1957-58 session was approximately Rs. 203 lakhs. The expenditure during the 1958-59 session is expected to be about Rs. 56 lakhs to which the Government will contribute some Rs. 48 lakhs as grant, the difference being met from the income to the Institute by way of student fees, grants for research etc. The estimated recurring expenditure during 1960-61, the final session of the second Plan period, is Rs. 72 lakhs and the income about Rs. 10 lakhs.

The Government of India with effect from the year 1957-58 have been giving to the Institute recurring grants to the extent of the excess of expenditure over income. As a large number of posts has not been filled and development of the Institute to the anticipated extent has not yet taken place, the recurring expenditure is much less than anticipated. If all the sanctioned posts were filled and if the Institute's activities developed as envisaged, the recurring expenditure would be about Rs. 74·13 lakhs. The break-up of this figure is given below:—

Pay (on average salary) of all staff . .	Rs. 32·40 lakhs.
Allowances and Honoraria	Rs. 8·83 „
Departmental Operating costs . . .	Rs. 5·80 „
(rising to	Rs. 7·20 „)
Other Charges . . .	Rs. 15·23 „
Contributory Provident Fund Accounts .	Rs. 2·62 „
Maintenance and Minor Works . . .	Rs. 9·00 „
Advances	Rs. 0·25 „

The amount of Rs. 74·13 lakhs does not include the amount that may be required for depreciation of buildings, equipment and furniture.

At present the Institute does not receive credit for the rent realisation of staff quarters, which is currently remitted to Government revenues. With the incorporation of the Institute all the properties including staff quarters will be transferred to the Institute and gradually the rent income will also accrue to the Institute. This will bring down the net expenditure to be borne by the Government of India.

28. The Ministry of Finance have at present fixed a ceiling of Rs. 44·61 lakhs as recurring expenditure. This figure has now been exceeded and it is suggested that instead of fixing a ceiling on the net expenditure to be paid by the Govrenment, a ceiling of about Rs. 80 lakhs on the gross expenditure may be fixed for the period up to the end of the second Plan and the question of revising this ceiling during the third Plan period may be considered only after a reassessment has been made as a result of the implementation of this Committee's recommendations.

29. The method of financing the Institute as presently followed leaves the Institute with practically no funds at the close of the financial year. This results in delay in making essential payments in the opening months of the following year. The Committee suggest that to overcome this difficulty, a sum of Rs. 10 lakhs should be given to the Institute as an opening balance to be carried forward from year to year. In other words, the total sums payable during 1959-60 should include about Rs. 10 lakhs in addition to "the cover-the-deficit-grant" given for that year.

SECTION III

Trends and Needs of Technological Development

30. The last few decades have been characterised by a fantastic range and pace of scientific discovery and technological development to which several countries have made notable contributions. This applies in the whole field of technology and is well illustrated by the achievements of the electrical industry within which in addition to much improved versions of types of equipment already well established at that time there are now being manufactured a diversity of other types of equipment which were either not conceived or were in no more than embryonic form as recently as 20 years ago.

31. These new achievements include television and radar; electronic analogue and digital computers for use not only for the solution of complex mathematical problems but also for business accounting and as components in automatic control systems; automation; the first trans-Atlantic telephone cable conveying more than 30 telephonic communications simultaneously; the semi-conductor device known as the transister as a replacement for the thermionic valve in a wide range of electric equipment; electron microscopes with magnifications in excess of 100,000 permitting the observation of single large molecules; particles accelerators capable of accelerating protons to energies of several thousand million electron volts for atomic physics research; small accelerators providing electrons at energies of a few million electron volts for use in medical diagnosis and treatment, for the irradiation of plastics to improve their physical properties and for the sterilisation of drugs and foodstuffs; nuclear reactors for research in atomic physics, and nuclear stations for the large scale generation of electrical power, each based on the fission of uranium nuclei; and experimental systems aimed at the generation of power by the fusion of deuterium nuclei in thermonuclear processes.

32. These several achievements have been made possible in varying degrees by the production on an engineering scale of a number of materials which also either did not exist, or were of no more than scientific interest 20 years ago. They include several new plastics such as polyethylene, polytetraflueréthylene, terylene and the silicones; the barium titanate ceramics; ferro-magnetics such as the ferrites; germanium and silicon produced in extreme purity for use as semi-conductors; and, in the nuclear power field, uranium, plutonium, thorium, zirconium, beryllium, vanadium, niobium, liquid sodium and potassium, and heavy water.

33. These new developments and the improvements in previously well established electrical products, too numerous to mention, are the result of the creative effort of scientists and technologists, and they have emphasised a growing inter-dependence among the various branches of technology and the increasing dependence of technological development in general on scientific discovery. They have demonstrated the increasing need for technologists to acquaint themselves with, and to interpret and apply, the work of chemists, physicists, metallurgists and mathematicians, and for representatives of the various scientific and technological disciplines to collaborate intimately in teams devoted to the translation of scientific discovery into economic technological achievement.

34. The individual scientist or technologist must necessarily become a specialist. Yet at any moment the possibilities of progress in his special field may become vitally affected by progress in another speciality not necessarily obviously related to it. To be a really successful specialist he must therefore be capable of looking well outside his own field—in other words he must also be a good non-specialist. He must learn to appreciate that the process of translating a new idea into a reliable engineering product involves the co-ordination of a diversity of skills, techniques, materials and experience; that the measure of individual achievement is the degree to which it fits into and helps to establish a co-operative programme and that the success of the individual is to be judged by the overall success of the team of which he is a member.

35. In the exercise of this function he will find himself responsible for the work of other people, some of whom will be older than himself and who have skills which he does not possess in equal measure, if at all; and he will be required to advise and instruct these men and to exercise authority over them in an effective manner. He must therefore be interested in, and be capable of resolving, human as well as scientific and technical problems in the realisation that his failure to do so will frustrate his individual work and may seriously retard the progress of the co-operative programme.

36. The concepts outlined above are embodied in the definition of the professional engineer which was approved at a conference of representatives of the Engineering Societies of Western Europe and the United States of America (E.U.S.E.C.) held in 1953 and at the Commonwealth Engineering Conference in 1954, and which reads as follows:—

> "A professional engineer is competent by virtue of his fundamental education and training to apply the scientific method of outlook to the analysis and solution of engineering problems. He is able to assume personal responsibility for the development and application of engineering science and knowledge, notably in research, designing, construction, manufacturing, superintending, managing and in the education of the engineer. His work is predominantly intellectual and varied, and not of a routine mental or physical character. It requires the exercise of original thought and judgment and the ability to supervise the technical and administrative work of others.
>
> His education will have been such as to make him capable of closely and continuously following progress in his branch of engineering science by consulting newly published work on a world-wide basis, assimilating such information and applying it independently. He is thus placed in a position to make contributions to the development of engineering science or its applications.
>
> His education and training will have been such that he will have acquired a broad and general appreciation of other engineering sciences as well as a thorough insight into the special features of his own branch. In due time he will be able to give authoritative technical advice, and to assume responsibility for the direction of important tasks in his branch."

37. The production of these professional engineers or technologists is a joint responsibility of the appropriate educational institutions and of the subsequent employing authorities, and it demands an intimate and enthusiastic partnership between the two sides.

38. On the former side, since neither the direction in which technology nor that in which the individual career will develop can be foretold reliably, it is essential that the knowledge and understanding which the student acquires during his technological education should be as fundamental and broad as possible. This education should aim to illuminate both experimentally and theoretically an inter-relationship between the different branches of science and technology; illustrated in the later stages of the course by a deep study of the particular branch of technology which the student selects to be the starting point of his career.

39. The knowledge he acquires must be broad so that he may learn to pursue the implications of facts outside their immediate context; but it must also be deep in some directions so that he may learn the dangers of superficiality and acquire a due humility about the limits of his knowledge. This need for depth is the educational, as distinct from the career, or professional, justification for a measure of specialisation in the later years of the course.

40. Most students take up a particular subject of study in order to acquire a body of specialised knowledge which they intend to apply in earning a livelihood, and it would be unrealistic to deny the importance of this utilitarian objective. But the acquisition of this specialist knowledge will be futile unless it gives his mind a cutting edge. It must give him practice in rigorous theoretical and experimental analysis, in weighing evidence, in detecting inconsistencies and in distinguishing between facts and value judgments. It must encourage independence of mind, that is it must teach him to think for himself. He must acquire high standards of objectivity and exactness; learn how to select what is relevant and significant and how to reason from the facts available to him. There is a danger, when the volume of available knowledge even in narrow fields is so enormous, that the utilitarian purpose of the special subject will drive the student to memorise as much as possible of this knowledge in the limited time available, leaving him no opportunity to develop his power of thought and to acquire knowledge outside his speciality.

41. This broad scientific and technological education affords only a partial preparation, however, for the solution of the wide variety of problems which arise in the practice of technology whether this be carried out in manufacturing industry or in the central services. It must be supplemented by a similarly broad training, before the graduate is attached to a particular, specialist, appointment within his chosen field of technology. In general, the duration of this training should be of the order of two years. The nature of it will vary with the field of technology and with the function in it—research, development, design, manufacture or operation—for which the individual proves to be best suited. The purpose of the early part of this training should be to give him a broad acquaintance with the basic skills, techniques and processes of his branch of technology, of the

kind of work involved in the exercise of the above-mentioned functions and of the essential inter-relationship between these functions. At the same time it will give him, and those responsible for supervising and advising him, opportunities to assess and develop his aptitudes and to discover his special interests and potentialities. The later stages of the training should then be devoted specifically to affording him a broad experience within the chosen function, in final preparation for carrying full professional responsibility for the exercise of it in whatever situation he may find himself.

42. It must be recognised that men who have been educated and trained as technologists on the broad lines indicated above, have not yet been produced within India.

43. The provision and organisation of good training facilities is expensive and demands considerable far-sightedness on the part of the employing authority. So far the training of selected men in this way has been ensured in a limited manner by sending them overseas. This arrangement is inadequate to meet the country's rapidly expanding need for technologists. The bulk of the training must be carried out at home and the employing authorities should face this responsibility as a matter of great urgency. It will of course delay the availability of the graduates concerned for attachment to specific, specialist posts, but this must be faced if the future of technology in India is to be adequately assured.

44. It should be prerequisite for entry to every course of postgraduate study that at least 12 months' training should have been undergone in an external establishment appropriate to the branch of technology concerned.

45. It now requires to be stated that full use can be made of men who have been educated and trained as technologists on the broad lines indicated above only if they are supported by adequate numbers of well trained technicians and craftsmen, each educated to a level appropriate to the functions he is to perform. The appropriate relative proportions of these three complementary grades of personnel vary from one branch of technology to another and within different domains of the same technology, but as a generalisation it would be reasonable to provide from five to ten technicians for each technologist.

46. A definition of the engineering technician which has been widely accepted within the United Kingdom reads as follows:—

> "An engineering technician is one who can apply in a responsible manner proven techniques which are commonly understood by those who are expert in a branch of engineering, or those techniques specifically prescribed by professional engineers. Under general professional engineering direction, or following established engineering techniques, he is capable of carrying out duties which may be found among the list of examples set out below.
>
> In carrying out many of these duties, competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a

particular branch of engineering, combined with the ability to work out the details of a task in the light of well established practice.

An engineering technician requires an education and training sufficient to enable him to understand the reasons for and purposes of the operations for which he is responsible.

The following duties are typical of those carried out by engineering technicians:

> "Working on design and development of engineering plant and structures; erecting and commissioning of engineering equipment and structures; engineering drawing; estimating, inspecting and testing engineering construction and equipment; use of surveying instruments; operating, maintaining and repairing engineering machinery, plant and engineering services and locating defects therein; activities connected with research and development, testing of materials and components and sales engineering, servicing equipment, and advising consumers."

47. If India is short of technologists she is relatively even more deficient in technicians who have been educated and trained specifically and adequately for this important purpose.

48. It is a fact that the majority of Indian engineering graduates are performing technician duties in the sense of the above definition. This is understandable in view of the present stage of industrial development in the country. In general, however, their engineering education has been too abstract, and their practical training quite inadequate, for the proper exercise even of these duties. In the opinion of a professor at Kharagpur, "In spite of the potentially good students admitted, the average product turned out is deficient in his confidence to translate theoretical ideas into practice. He is generally formula-minded, lacks in physical visualisation of facts, is deficient in appreciation of details, possesses to some extent a disdain towards manual work and drawing, and considerably lacks the ability to learn from direct observation." And for the majority of these no facilities for subsequent systematic practical training have been, or are yet, available.

This is a serious situation, and it cannot be over-emphasised that the attempt to correct it at the level of the technologist will be ineffective unless there is a simultaneous and larger scale attempt at the level of the technician.

49. In the opinion of the Committee an urgent need exists for a comprehensive enquiry into this technician problem, embracing the contributions to its solution of the graduate courses of the Engineering Colleges, the diploma courses of the Polytechnics, and the training facilities of industry and the central services. Although strictly outside their terms of reference, they nevertheless wish to recommend that a special committee be set up for this express purpose.

Success will depend on the energy, discipline and co-operation of the educational and industrial partners in this great enterprise.

SECTION IV

The Place of the Institute in the Educational Structure of India

50. The original intention behind the decision to establish the Institute of Technology, Kharagpur was ostensibly to ensure a supply of technologists of the quality envisaged in the preceding section. With this in mind the undergraduate student entry has been made by careful selection from a large number of qualified applicants and we have been impressed by their quality both as students and as men. The Institute has also succeeded in recruiting as staff members many men of high reputation and wide experience who, with their more junior colleagues have approached their creative tasks under difficult physical circumstances with commendable enthusiasm and vigour as evidenced by the advanced state of development of the laboratory facilities. The laboratories have been equipped on a generous scale, well in advance of other engineering colleges in the country, and in some cases they compare favourably with the best of their kind available in the United Kingdom.

51. As is to be expected in an Institute of Technology of the highest rank in which post-graduate work is to occupy an important place, the overall student-teaching staff ratio is low. It is 7:1 on the basis of the existing student—teaching staff populations and 6·5:1 reckoned on the sanctioned student and staff figures.

52. Nevertheless the Committee are of the opinion that the undergraduate courses are not yet fulfilling their intended purpose. The curricula still conform too closely to the traditional form of engineering course in the country and because of this orthodox character are failing to reflect sufficiently the advancing front of technological development. The Committee say this notwithstanding that the undergraduate products are said by some employing authorities to be of better quality than are generally available from other engineering colleges. It would be surprising if this were not the case in view of the highly selective entry and the excellence of the laboratory facilities. But the aim of the Institute must be to go beyond producing graduates who can deal more efficiently with present-day problems of an orthodox character, important though it is that there should be many more such men. It must be to produce graduates who, in addition to doing this, can prepare for, and take creative initiative in, future situations.

53. A basic factor contributing to the too orthodox character of the undergraduate courses is the extremely limited impact which the Departments of Physics, Chemistry and Mathematics are making on the technological teaching generally. In the main the contributions of the Physics and Chemistry Departments are limited to the first year, and that of Mathematics to the first and second years, and the scientific foundation for the later technological studies which they

afford is quite inadequate. No serious attempt appears to have been made to ensure a proper appreciation in the undergraduate mind of the increasing importance of these basic subjects in the development of technology. For example, there is little evidence within the science and technology curricula as a whole of an attempt to deal in a fundamental manner with the properties of materials; to illustrate and explain how nuclear, atomic and molecular structure, chemical composition and physical, electrical, magnetic and mechanical properties, are inter-related; and to emphasise the extent to which progress in the several branches of technology is dependent on the production of new materials and the improvement of well-established ones. There is urgent need for the teaching in Physics and Mathematics, and to a lesser extent that in Chemistry, which forms a common obligatory part of the several undergraduate courses—more particularly of the courses in the primary technologies of civil, chemical, electrical, mechanical and metallurgical engineering—to be carried to a more advanced level and to be more fully illustrated by properly phased experimental work; and also for the teaching of these basic subjects to penetrate into the later years of the undergraduate courses in a form appropriate to the special needs of the several technologies.

54. The Committee appreciate that these additions to the undergraduate technological curricula can be achieved only by a corresponding reduction in the attention devoted to certain portions of the existing courses. The parts to be dealt with in this way should be those which are of an essentially detailed and repetitive character aimed at developing particular skills rather than depth of understanding, such as the over-elaboration of specialized factual detail in the lectures and of straightforward calculation in the tutorials of routine experiments in the laboratories and repetitive drafting in Drawing Offices.

55. The desired result will not be achieved however merely by increasing the scope of science teaching, if it is taught in the sense of the honours science schools, and if the science staff concerned remain as at present largely locked up in their own departments. For this reason, the Committee do not support the suggestion that entrants to the proposed Five Year Integrated Undergraduate Course should be given the option of proceeding to a B.Sc. Hons. degree in Science at the end of three years.

56. The aim must be to strengthen both the foundations and the advanced specialised sections of the technological teaching by requiring the staff of the Physics, Chemistry and Mathematics Departments to identify themselves personally with the technological departments and with the post-graduate teaching and research work being undertaken in them, in both its experimental and theoretical aspects.

57. For example, progress in the design of large power transformers and rotating electrical machines is being increasingly conditioned by the availability of new grain-oriented magnetic sheet steels which involve the metallurgist, by new electrical insulating materials produced by the chemist and the physicist; by the solution of complex problems in electro-magnetism and in electric stress distribution, which demand the application of computing techniques and the help

of the mathematician; and by increasing attention to such questions as ventilation and cooling, vibration and noise generation, which are of an essentially mechanical engineering character but necessarily draw on physics and mathematics for their effective solution. As a further example, the transistor, referred to in Section III may be treated in a purely external sense as an electric circuit component. Its behaviour depends, however, on the electronic conduction processes in highly purified semi-conducting materials such as germanium, an understanding of which involves metallurgy", physics and mathematics. Lacking this fundamental understanding of the solid state, the student can acquire only a superficial appreciation of the behaviour and potentialities of this new device.

58. The foregoing remarks are not intended to discourage an adequate pursuit of research in the basic sciences as such, nor is it a criticism of the quality of much of the scientific research in progress in the science departments. The Committee feel, however, that too little of the research now being undertaken by the science departments takes the form of a collaborate effort with the Departments of Technology, and that this matter calls for thorough interdepartmental reconsideration.

59. It would not be correct to give the impression, however, that the responsibility for the above-mentioned inadequacies resides wholly with the staff of the Science Departments. Due no doubt in part to the limitations imposed by the industrial situation in India, we have found much evidence that the Departments of Technology have imposed a restriction on the amount of science teaching in favour of concentration on their own departmental subject studies, and that they have not yet sought as close a link with the Science Departments in the field of post-graduate study and research as is desirable. Moreover, this tendency to water-tight departmentalism would seem to exist also as between the Technology Departments themselves at both the undergraduate and post-graduate levels. Progress in technology nowadays requires the intimate collaboration of representatives of several disciplines and it is essential that an Institute which is devoted to the production of technologists, and to the advancement of technology, should be, itself, a living example of this pattern of collaboration.

60. The Committee think it desirable at this point to remove a possible misinterpretation of their argument. In stressing the need for a fuller integration of the teaching of science with that of the technologies, and of the several technologies among themselves, they do not aim at the production of technological theorists. What is wanted are men with a practical outlook towards their chosen branch who are capable of seeing and contributing to the evolution of practice in this branch against a wider, and an ever widening, scientific and technological background.

61. An illustration of this need, and of the way in which new developments in technology demand the collaboration of representatives of a variety of disciplines, is afforded in India by the Atomic Energy Establishment in Trombay. It could be helpful if a group of representatives drawn from several departments of the Institute

were to pay a visit to this Establishment for the purpose of making a study of this matter. They should also, if possible, visit the research and development departments of a number of the large industrial concerns in Western Europe and the United States of America and the analogous organisations in the U.S.S.R.

62. The Committee have observed that the number of students participating in the individual post-graduate courses is almost invariably less than the target figure, and that the overall number is disappointingly low. Moreover, too few of the participants have had the minimum of 12 months' industrial or similar training and experience which the Committee consider a prerequisite for entry on a course of high specialised post-graduate study. Several departments wish, following discussions with their Advisory Committees, to introduce additional courses, but it is the Committee's opinion that generally speaking these additions should be deferred until the existing courses have been more fully consolidated. They also think it essential that when considering further additions, full account should be taken of such post-graduate courses as exist already at the Indian Institute of Science, Bangalore, and as are contemplated in the Institutes of Technology at Bombay, Madras and Kanpur. It is highly desirable that an effective means should be established for ensuring collaboration and avoiding duplication in this and other matters between these institutions.

63. Mention has already been made of the generous way in which the laboratories have been equipped and of the contribution which this has made to the production of graduates of improved quality. It may nevertheless be regretted that so much of this new equipment is of an advanced commercial type and has been acquired without adequate prior thought about its educational justification and purpose. Unless used with discretion some of it is likely to inhibit a creative approach and constrain initiative in experimental work. It is an essential part of the educational experience of the young technologist not only that he must learn to use highly refined apparatus produced by others but learn also how to devise it for himself. It must also be mentioned that in consequence of the limited degree of inter-departmental collaboration which exists, less overall use is being made of some of this highly expensive equipment than should be the case; and indeed some of the requests for additional equipment which have been made suggest that several departments are not adequately acquainted with each other's present possessions.

64. The Committee's observations on the departments given in Section VIII deal with the departments' requests for additional accommodation, staff and equipment in the light both of the above arguments and of the Committee's recommendation in Section V that the annual number of undergraduate entrants should be reduced.

65. It would not be proper to conclude this critical commentary without congratulating the teaching staff of the Institute on the excellent work they have done departmentally and on what they have achieved from nothing in so short a period of time. A considerable measure of localised thinking was perhaps inevitable in this formative period. But the time has now come for departmental thinking and planning to take inter-departmental form, and for the Institute

to be transformed from a set of separate departments into an intimately co-ordinated whole. For this to be achieved it is essential that more effective means of inter-departmental discussion at a level below that of the Academic Council should be established as a matter of urgency.

The Number of Students and Related Questions

66. In the preceding section mention was made of the Committee's intention to recommend a reduction in the annual intake of undergraduate students to the Institute from the present sanctioned figure of 407 as stated in Table 1 of Appendix V, and it is now necessary to elaborate this intention.

It is stated in paragraph 25, Section 1, that the six students' Halls already in use and the seventh now rapidly approaching completion have been designed to accommodate 1,800 students, which exceeds by 179 places the present student population of 1,621. (Table IV, Appendix V).

67. This population comprises 1,446 undergraduates and 175 post-graduates, giving a ratio of undergraduate to post-graduate students of more than 8 to 1, a ratio markedly higher than that of 2 to 1 envisaged by the Sarkar Committee. Moreover, even if the whole of the above-mentioned 179 vacant places were to be filled by post-graduate students, the ratio would still be 4 to 1.

68. The Reviewing Committee would like to see a rapid approach to this ratio through the organisation of post-graduate courses of a few weeks duration, as well as through a marked increase in the number of graduates attending the existing, and a few carefully chosen additional courses of one or more years' duration. This will require an increase in the sanctioned intake capacity of many of the existing courses from the present rather low figures. As an incentive to students, the Committee recommend that an increased number of scholarships of higher value should be offered for post-graduate studies in technology.

69. This growth of post-graduate work may well take some time to develop, but accommodation must be reserved for it, and this would necessarily involve a reduction in the undergraduate population unless of course additional hall facilities are provided. As indicated in paragraph 25, Section II, these have indeed already been requested in the form of two further halls for 200 and 50 students respectively. It is evident, however, that the cost of this accommodation would be only one of the consequential additional items of expenditure. Requests for supplementation of the present departmental facilities in respect of laboratory and classroom space, equipment and staff necessarily follow, and have in fact already been made by several departments. The Committee feel strongly that it would be undesirable to incur further expenditure on these ways until at least a number of outstanding requirements of considerable urgency affecting the communal life of the present staff and student bodies have been fully dealt with. These are discussed in Section VI.

70. With a four year undergraduate course as now operated, a mention of this population at around the present figure of 1,446 would permit an annual intake little in excess of 360 as compared with the present sanctioned annual entry of 407, unless the failure rate is to rise substantially above the low figure shown by a comparison of Tables III and IV of Appendix V. On the basis of the proposed Five-Year Integrated Course, however, the corresponding annual intake of undergraduates would be four-fifth of 360, that is about 290.

71. After careful consideration, the Committee recommend a lower undergraduate intake than this for some years for the following reasons additional to the accommodation one given above:

(i) The re-orientation of the undergraduate curricula, and those of the post-graduate ones also, along the lines discussed in Sections III and IV will demand considerable re-thinking and re-planning by the teaching staff and will make heavy demands upon it;

(ii) A supplementary output of graduates will occur from the courses which have now commenced at the sister Institute of Technology, Bombay, and also from the two further Institutes at Madras and Kanpur whose opening is pending.

72. The Committee are also aware of the Government's plans for the establishment of a number of additional colleges of engineering and technology, and of its desire that the standard of the undergraduate courses in them and in other already existing colleges, shall compare with that of the courses at the four Institutes. The Committee would welcome an acceptance in these colleges of the educational principles to which they have tried to give expression. One important consequence would be that their graduates could then enter the post-graduate courses at Kharagpur and its sister Institutes on an equal footing with the products of these institutions.

73. Bearing these developments in mind, it is the Committee's opinion that the effect of a reduction in the undergraduate numbers at Kharagpur would not be significant relative to the benefits which would result from the Institute's achievement of the changes they propose. They believe a reduction in the undergraduate number to be a necessary condition for this achievement.

74. The Committee, therefore, recommend that the annual intake to the Five-Year Integrated Undergraduate Courses should not exceed 240, made up as follows:—

Mechanical Engineering	50
Civil Engineering	45
Electrical Engineering (including Electronics and Communications) . . .	45
Chemical Engineering	20
Metallurgical Engineering	20
Other Technologies	60

75. On the assumption of an absence of further failures among the present undergraduates this would give an undergraduate population in the 1959-60 session of about 1,400 leaving 400 places in the Halls for post-graduate students of various kinds.

76. The Committee have not attempted to subdivide the proposed entry of 60 to other Technologies among the courses in agricultural engineering, architecture and regional planning, mining engineering, naval architecture and marine engineering, and geology and geophysics. The present sanctioned annual intake to these courses is 117 and this would presumably fall normally to about 95 under the five-year integrated course arrangement. The proposed reduction to 60 is based not only on the considerations given in the foregoing but takes account of the fact that the courses in some of these subjects are not popular relative to those in the technologies specified in the above table; and is also expressive of the Committee's doubt as to the wisdom of the decision to provide undergraduate courses in them at Kharagpur.

77. The Committee have been informed of the arrangements by which the undergraduate entrants are selected from candidates drawn from all over India, and of the fact that the award of scholarships is based not on the entrance examination but on one held within the Institute during the first term of attendance. They are doubtful about the merits of this procedure and would favour one which identified the award of scholarships wholly with the entrance examination. In respect of these scholarships awards they strongly recommend that a reduction in the annual intake should not carry with it a reduction in the annual number of awards, so that a larger proportion of those admitted may be given the benefit of them. In fact they recommend that the annual expenditure on scholarships should be increased. These are important factors affecting not only the retention of the all-India character of the student body, to which both the Institute and the Reviewing Committee attach great weight, but also in ensuring that the entrants to the Institute are of the highest quality available. It is essential that students should be assured prior to their admission regarding the financial assistance which they can expect.

78. A reduction in the annual intake of undergraduates would necessarily reduce the student-teaching staff ratio below the present figure of 7 to 1, unless there is a compensating increase in the number of post-graduates. Moreover, the Committee's proposals will modify somewhat the balance of staff among the various departments. In dealing with these problems it may be appropriate to hold some of the sanctioned posts in abeyance or to transfer them from one department to another, and also in the interests of inter-departmental collaboration for some of the existing staff to contribute to teaching outside the particular technology to which they were appointed. This might be specially valuable in affording assistance to the staffs of the Physics, Chemistry and Mathematics Departments in their expanded activities.

79. In concluding this Section, the Committee find themselves urged to express their concern about the very large aggregate number of undergraduates which is being envisaged for the four Institutes of

Technology and the other engineering colleges of the country, if the intention of the courses in these institutions is to produce technologists. Their concern arises from the following considerations.

80. Firstly, notwithstanding the unquestionable innate ability of a large proportion of India's youth, these numbers are unlikely to be realisable for many years with boys who have been adequately prepared for entry. Unless therefore there is associated with this large entry a failure rate in the earlier stages of the courses of a considerably higher order than is now common, not only will the average quality of the graduate output be too low but that of the best students will be affected adversely.

81. Secondly, and bearing on the first point, there is not yet available anything like a sufficient number of teachers in the country, adequately qualified by their education, training and experience, to ensure the proper technological education of these large numbers. A natural consequence of this is an adherence to orthodox forms of instruction, of subject matter in both lectures and laboratory, and of examination paper, which is liable to fail to impose the analytical and experimental disciplines, and to generate the progressive outlook required.

82. Thirdly, the facilities in industry and the central services necessary for the satisfactory training of technologists in large numbers do not yet exist; and

83. Fourthly, the needs of industry and the central services would probably be met more effectively for the next decade at least by concentrating, as indicated at the end of Section IV, on the production of a quite small number of first-rate technologists and of a relatively very much larger number of men specifically educated and trained to perform the duties referred to in the United Kingdom definition of Engineering Technician given in Section III. The relative proportion of these categories will necessarily require adjustment as the industrialisation of the country progresses, and as it takes over from others the creative initiative in industrial development. This will be a difficult process but India can approach the task in the confident knowledge that an ample supply of native talent is available.

Campus Amenities

84. In this section the Committee gather together their observations on a number of items which may broadly be classified as amenities for the Campus population. Some of their main recommendations in this respect spring from the repeated demands of representatives of various groups of staff and students. It appears to the Committee that the meeting of some of these demands on the lines suggested in the following paragraphs would go a long way towards eliminating a sense of shortcoming in the arrangements made by the Institute for essential amenities.

85. *Hospital*: There is a hospital located in one of the old buildings and the facilities provided are mainly for out-patient treatment, though there are a few beds wherein students can be kept in detention on a non-dietary basis. Some of the group representatives of the staff expressed a sense of grievance at the fact that where hospitalisation is necessary a distinction is made between grades of employees; some of them are directed to the Railway Hospital, which is a well-equipped one, and others are sent to Prem Bazar Hospital at Kharagpur where the staff feel that medical attention is not adequate. The Committee would recommend that the Institute should arrange to have a well-equipped hospital opened in its own building in the Campus. It would require consideration whether the staff of this hospital should be drawn from the Government of West Bengal or from the Central Medical Service which is being constituted by the Ministry of Health.

86. *Higher Secondary School*: There is a sponsored school in the Campus using Bengali as the exclusive medium of instruction. The staff of the Institute of Technology, who are drawn from all parts of India, have put forward a demand that parallel sections be run in the Middle and Secondary classes of this school wherein the medium of instruction would be Hindi and English. This, in the Committee's view, is a desirable step and would go a long way to ensuring contentment among the staff. Pending fuller consideration of this proposal, the Committee would endorse another suggestion made by representatives of the employees that free or subsidised transport should be made available for conveying the children to schools in Kharagpur.

87. *Electricity Supply*: Electric power to the Institute is obtained by means of the Damodar Valley Co. 66 KV Grid. The supply is transformed down to 33 KV. to feed the West Bengal State Electricity Board Sub-station at Kharagpur where it is again transformed down to 11 KV for distribution by overhead line to the two sub-stations of the Institute, one situated in the main building and the other in the residential area. Each sub-station is designed to handle 500 KV.A.

but that in the residential area is at present equipped with only a 200 KV.A. Distribution from the two sub-stations is at 400 V. 3 Phase.

A third sub-station is under construction for which the transformer is available but the switchgear has been delayed due to import licence restrictions. The switchgear should be available in April, 1959 and should be installed by June, 1959.

As the overhead 400 V. mains system has been built up in a piecemeal fashion, certain sections of the mains are overloaded leading to an inadequate voltage being supplied, particularly in the residential area. This mains system needs replanning and overhaul but this would be expensive to achieve under contract because of the inevitable interruptions to the flow of work. It is recommended that the Institute should take over this task and replan the mains system departmentally. This could be started from April 1, 1959 when the Institute will take over from the C.P.W.D. the responsibility of running the supply system within the Institute.

88. *Water-Supply*: The existing scheme of water-supply to the Campus, which depends on a number of local tube wells, is inadequate to meet the basic minima set down by sanitary standards. An enlarged water-supply scheme has been sanctioned and is estimated to cost about Rs. 24 lakhs. The Engineer-in-Charge considers that this scheme will not be completed before March, 1961. While the Committee recognise the inherent difficulties in expediting receipt of supplies of pipes, pumps, etc., they would strongly urge that every effort should be made to bring the water-supply into commission at an early date.

89. *Student Gymkhana*: The Committee lay great stress on the provision at the earliest possible date of adequate Gymkhana facilities for the students. This would encourage a better corporate life among them and would have considerable educational advantages. A covered pavilion, a Gymkhana building and more playing fields are needed immediately. It is estimated that these developments will cost about Rs. 5 lakhs. The Committee would also recommend the early completion of the Swimming Pool with the ancillary chlorinating and filtering plants.

90. *Shopping Centre*: The provision of a shopping centre is regarded by the Committee as an important amenity which needs early attention. Though a temporary market is now functioning, the Campus requires more permanent arrangements in this regard.

91. *Maintenance (Engineering) Unit*: The Institute will take over the maintenance of buildings, roads, etc. in the Campus from 1st April, 1959. It is suggested by the Committee that the Maintenance Grants payable to the Institute should be calculated on the standard percentages basis adopted by the C.P.W.D. The strength of staff to be employed will depend on the workload and in any case the cost of such staff will come out of the provision for maintenance. The Institute should be permitted to utilise any savings on this to making minor improvements in the Campus.

92. *Improvement in the Halls of Residence*: The Committee are inclined to consider sympathetically the proposals put forward by

student representatives that covered cycle sheds with sufficient accommodation should be provided in all the Halls of Residence. It was also suggested that a certain proportion of kitchen staff and room boys of the Halls should be provided with quarters near the Halls as such staff is on duty for long periods of the day. In the Committee's view, such a provision is desirable.

93. In view of the recommendations made by the Committee for reduced undergraduate admissions, it may not be necessary to undertake the construction of as many staff quarters as shown in Table XIII of Appendix V, and of additional educational buildings to the extent envisaged up to the end of the second Plan period. Some of the funds required for the Campus amenities detailed above may therefore be obtained by diversion of already approved funds. However, at best, this could meet only a part of the requisite expenditure and the Government should provide the necessary additional money for these purposes.

SECTION VII

Staff, and Staff-Student Relations

94. Arising out of the papers submitted to them, of their departmental and other visits, and of their discussions with representatives of the various categories of the staff and members of the student body the Committee have commented upon and made proposals about particular aspects of the activities of the Institute in the appropriate Sections of the Report. In supplementation of these they wish to offer the following general remarks about the staff, and staff-student relations.

95. The establishment of a large new residential institution comprising many scientific and technological disciplines in a self-contained campus of its own far from the distractions of a city, provides many potential attractions and advantages. The advice of experts in the various fields of study and research is readily available; the duplication of costly equipment required by more than one department can be avoided; and the difficulties arising from temporary shortage of staff in one department can be overcome to some extent by utilising the services of members of staff of other cognate departments.

These potentialities will not be realised, however, if each department is allowed to develop into an ivory tower, serving its own individual ends, as it sees them, and, whether consciously or unconsciously, withholding its knowledge, experience and facilities from the common pool. There must be frequent consultation and ready collaboration not only between the Heads of Departments but also between the staff members at all levels. There must be not only constant reviewing and planning within individual departments but also between departments, and all categories of staff must have the opportunity of contributing in their appropriate capacities. This opportunity affords satisfaction, and a "sense of belonging", to the junior teaching staff concerned, it improves morale, and it provides training for future responsibilities.

The Committee found an inadequacy of collaboration both within and between departments along these lines.

96. It is a truism to say that a man gives of his best if he is satisfied. This does not always require that his physical needs are fully met. Every reasonable person can appreciate difficulties and the Institute has had, and still has, many. But the individual must feel that he and his colleagues can be heard and that their point of view will receive full and fair consideration. No group of workers should feel either neglected or isolated. Otherwise, misunderstandings, suspicions and distrust are likely to result in unjustifiable fears and dissatisfactions which may develop into serious

grievances. Effective channels of two-way communication, and prompt action where this is possible, are necessary if mutual trust and good morale are to be created. It is not sufficient for those in authority to be doing their best; it must be clearly evident that they are so doing.

The Committee feel strongly that immediate steps should be taken to create an improved situation in these respects, so that present misunderstandings and dissatisfactions may be removed, and that the staff generally may derive a deeper satisfaction in, and responsibility towards, the institution they are helping to create.

97. The Committee also observed that the student community is anxious to establish a closer contact with the teaching staff in its extra-curricular activities. Quite rightly, the students are not satisfied with the occasional meeting with a proportion of the staff at organised functions, or with the visits of the Wardens in the course of their Hall duties. One of the most important reasons for making the Institute fully residential in character is to bring about between students and staff, drawn from all over India, a constant exchange of ideas and experiences drawn from many sources as an integral part of the total educational activity. The situation and circumstances of the Institute place a special responsibility on the teaching staff for engendering a vigorous and healthy student corporate life. It would seem that they are not contributing all they should towards this end, and towards assisting the student body to overcome the difficulties associated with the limited facilities as yet available to them.

98. The Committee are anxious to make it clear that the state of affairs reflected above appears to have resulted in considerable measure from procedural difficulties and to the rigid codification of rules governing the affairs of the Institute. It is understood that the Board of Governors has taken steps to review and revise certain clauses of the Statutes and it is to be hoped that these will relax some of the restrictions which appear to be hampering the conduct of the Institute as an autonomous body.

SECTION VIII

Departments

99. In Sections III and IV of the report we have made proposals for the reorientation of the undergraduate courses and commented on the need for the Departments of Physics, Chemistry and Mathematics to play a fuller part in the undergraduate and post-graduate teaching and research work in the technological departments. In Section IV we have also drawn a distinction between the significance within the Institute of the technologies of Civil, Mechanical, Electrical. Chemical and Metallurgical Engineering and those of Agricultural Engineering, Architecture, Mining Engineering, Naval Architecture, Geology and Geophysics, and in Section V have recommended a reduction in the annual intake of undergraduate students and have given our reasons for this decision.

100. The implementation of these proposals will call for a considerable rethinking of the undergraduate and post-graduate curricula on an inter-departmental basis and will involve a reconsideration of the requests for additional accommodation, equipment and staff presented to us by the several departments.

101. In view of these considerations and the proposed introduction of the five-year integrated course, our comments on the requests of the individual departments are necessarily tentative but they nevertheless indicate the broad nature of our reactions to them.

102. There are several other matters which we should now like to mention.

(i) We were impressed by the general excellence of the laboratory accommodation and of the way in which the experimental equipment has been installed in it, and wish to congratulate the staff on this achievement and on the enthusiastic manner in which they have undertaken this complicated task. Generally speaking, we were also pleased with the arrangements made for the conduct of the students' laboratory work.

(ii) We were not so satisfied about the examination work, however, and feel obliged to make critical comment on it in furtherance of the remarks made on the subject in Section V.

(iii) In the course of our departmental enquiries we were informed of the low undergraduate failure rate and that in 1958 more than 80 per cent. of the final year students of civil, electrical, mechanical and Metallurgical engineering were awarded 1st Class degrees. We were led, therefore, to study the 3rd and 4th Year examination papers of two departments and the candidates' scripts on them. We found that the high average of the marks awarded was not inconsistent with the candidates answers. On the other hand we observed that the questions were largely of an orthodox and straightforward character, that in some cases the subject coverage of the questions was extremly limited and that in consequence substantial sections of the relevant course syllabuses were not represented.

(iv) In one of the final examination papers, for example, all five questions were devoted to a single topic and demanded no more than the straightforward use of appropriate formulae. It was surprising to learn, therefore, that the use of books, in which these formulae could readily be found, had been permitted in this examination. Similar comments could be applied to several of the other examination papers studied.

(v) While terminal examinations may justifiably be of limited scope, we think it essential that the sessional examinations should be representative of the whole curriculum and moreover that the questions set should impose a more severe test of the candidate's ability to think fundamentally than appears to be the case at present.

103. We enquired into the arrangements made for providing the undergraduates with training in industrial and similar external organisations during their long vacations, and were concerned to learn that in many cases the duration of this amounted to no more than six weeks throughout the undergraduate period. We have referred elsewhere to the great importance which attaches to the supplementation of technological education by systematic training, and while appreciating the difficulties which exist, feel that this matter requires fuller attention and correction.

104. On a related matter, we were informed of the arrangements within the Central Workshop for the training in basic workshop processes of a proportion of its young recruits, and would like to compliment the Head of the Workshop on them. We also learnt of the modest evening class facilities for the continued general education of some of the subordinate staff. Both these are important aspects of the responsibility of the Institute, but these facilities are no more than a good start. Much remains to be done to assist all categories of supporting staff to equip themselves to perform their respective functions more effectively and to engender in them a sense of real responsibility towards the work of the Institute. We recommend that a suitably constituted Committee should be requested to enquire into this important question and formulate proposals for a more extensive scheme of part-time education and of associated technical training.

105. Our final point concerns the Departmental Advisory Committees, the Minutes of whose meetings we have studied. Our impression is that the function of these committees have not been sufficiently clearly defined, and we feel that this matter be given further consideration by the Academic Council and the Board of Governors. It would seem desirable for the Advisory Committees to meet more frequently than once a year and to accept a special responsibility for ensuring an increased flow of post-graduate students to the Institute within the fields of technology which they represent.

Department of Agricultural Engineering

106. The Department of Agricultural Engineering was started in the year 1952 and the undergraduate course was started in the same year. The duration of the course is four years and the present annual intake capacity is 30. The total number of students in the

undergraduate course is at present 66. Year-wise figures are also given below:

1st year	19
2nd year	9
3rd year	21
4th year	17
Total .	66

The first batch of students graduated in the year 1956 and so far 58 students have passed the undergraduate course.

The Department conducts post-graduate courses in:—

(i) Farm machinery and power

(ii) Soil and Water Conservation Engineering

(iii) Applied Botany.

The annual intake capacity for each of the post-graduate courses and the number of students at present admitted to the course are shown against each course:

Sl. No.	P. G. Course	Intake capacity	Students admitted at present	Staff Members
1.	Farm Machinery and Power .	4	2	1
2.	Soil and Water Conservation Engg.	4	4	..
3.	Applied Botany	4	1	1
	TOTAL	12	7	2

It also conducts research in the field of:

(i) Designing of improved agricultural implements

(ii) Studies in soil moisture relationships

(iii) Studies in soil aggregation

(iv) Studies in soil loss and run-off

(v) Studies in weed control by chemicals

(vi) Studies on genetics and growing of legumes

At present there are three research scholars working in the Department.

The position of the sanctioned and existing staff is given below:

	Sanctioned	Existing
A. Academic	18	14
B. Technical	14	13
C. Class IV	16	16
	48	43

The Department has at present 16,910 sq. ft. of accommodation, of which 11,902 sq. ft. are used primarily for undergraduates and 5,008 sq. ft. for post-graduate and research work.

The Department has equipment costing Rs. 2,81,468. Equipment costing Rs. 1,93,694 is used for the undergraduate course and equipment costing Rs. 87,774 is used for the post-graduate and research work.

Operating cost: The Department gets an operating annual grant of Rs. 25,000.

Other activities: In addition to the undergraduate, post-graduate and research work, the Department is doing consultative work for the Damodar Valley Corporation Regional Planning.

Proposals: The Department has now requested for additional accommodation of 5,311 sq. ft. of which 3,744 sq. ft. will be required for the under-graduate work and 1,567 sq. ft. for post-graduate work and research work. This accommodation of 5,311 sq. ft. is at present occupied by the Mining Engineering Department in the new Agricultural Engineering building. If this is released, no additional accommodation is needed by the Department.

There is also a request for equipment costing Rs. 1,50,000, of which equipment costing Rs. 1,05,000 will be required for undergraduate work and equipment costing Rs. 45,000 for post-graduate and research work. In addition, the Department will require Rs. 50,000 for development of the Experimental Farm.

The additional staff required is:

Assistant Professor in Agronomy . . .	1
Assistant Professor in Farm Irrigation and Drainage	1
Senior Research Assistant	1
Junior Research Assistant	1
Tractor Supervisor	1
Technical Assistant	1

Committee's Observations

The Committee were not satisfied by either the present objectives or the standard of work of this Department at those of the undergraduate and post-graduate levels, and feel strongly that the whole position should be reviewed by the Advisory Committee of the Department. They further suggest that the Advisory Committee may consider the feasibility of reorienting the undergraduate course in such a manner as would enable the products to be utilised in the agricultural co-operatives which are being planned on a countrywide scale.

Department of Architecture and Regional Planning

107. The Department of Architecture and Regional Planning was started in the year 1951 (December) and the undergraduate course was started in the year 1952 (July). The duration of the course is five years and the present annual intake capacity is 30. The total number of students in the undergraduate course is at present 90. Year-wise figures are also below:—

1st year	23
2nd year	12
3rd year	20
4th year	13
5th year	22

The first batch of students graduated in the year 1957, and so far 26 students have passed the undergraduate course.

The Department conducts a two-year post-graduate course in Regional Planning (Town and Country Planning). The annual intake capacity for each of the post-graduate course and the number of students at present admitted to the courses are as shown against each course:

	Capacity		
	1st year	2nd year	
Regional Planning	8	8 =	16
	Present strength		
	1st year	2nd year	
	4	6 =	10

It also conducts research in the field of Regional Planning and Housing and is currently engaged in association with the Calcutta and Patna Universities in survey and research for a Pilot Regional Planning

Project at the behest of the Planning Commission for the Damodar Valley and the surrounding areas. This work is being guided by the Joint Committee for the Diagnostic Survey for the Damodar Valley Region set up by the Government of India under Chairman, Damodar Valley Corporation. Prof. V. N. Prasad is the Member-Secretary of this Committee. The following members of the Departmental staff are working on the Project:—

(i) Prof. V. N. Prasad.
(ii) Prof. D. V. R. Rao.
(iii) Mr. Tan Lee.
(iv) Mr. Rattan Kumar.

Other members of the staff and students are also called upon to assist whenever necessary. At present there are no Research Scholars working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	*Existing*
A. Academic		
(*a*) Head of the Department (Senior Professor) and Part-time Deputy Director	1	1
(*b*) Professor	1	..
(*c*) Assistant Professor	4	3
(*d*) Lecturer	6	5
(*e*) Assistant Lecturer	2	2
(*f*) Instructor	4	..
(*g*) Senior Research Assistant	..	..
	18	11
B. Technical	5	4
C. Ministerial	1	1
D. Class IV	2	2

The Department has at present 11,266 sq. ft. of accommodation, of which 8,971 sq. ft. are used primarily for undergraduate work and 2,295 sq. ft. for post-graduate and/or research work.

The Department has recently purchased equipment costing Rs. 0·59 lakhs, used both for undergraduate and post-graduate course and/or research work.

Operating cost: The Department gets an operating annual grant of Rs. 5,000.

Other activities: In addition to the undergraduate and research work, the Department is doing consultative and research work for industry and other organisations.

Proposals: The Department has now requested additional accommodation of 5,700 sq. ft. 2,600 sq. ft. will be required for undergraduate work and 3,100 sq. ft. for post-graduate and/or research work.

There is also a request for equipment costing Rs. 1,60,000 both for undergraduate and post-graduate course and/or research work.

The additional staff requested for consolidating the work of the Department and for starting post-graduate courses in Architecture, Landscape Architecture, Rural Housing and Planning, etc. is:

Professor	2
Assistant Professor	4
Lecturer	4
Part-time Lecturer	2

Committee's Observations

The Committee were impressed by the quality of the work being carried out in this Department. On the other hand they were disappointed to find that the courses were not proving popular apparently due to their location at Kharagpur. In view of this they do not recommend any additional staff, equipment or accommodation at the present stage and question the desirability of starting any new post-graduate courses in the near future.

Department of Applied Chemistry

108. The Department of Applied Chemistry was started in 1951. It teaches Chemistry during the first year of the undergraduate course of civil, electrical, mechanical, agricultural, mining engineering and naval architecture, and during the first two years of the undergraduate course of geology and geophysics and first and third year of chemical engineering and for three years of the metallurgical engineering undergraduate course.

The Department conducts the following post-graduate courses:

Subject	Year started	Duration	Annual intake capacity	Present strength	Number successfully completed so far
1. Technical Gas Reactions and High Pressure Technology .	1954	1	8	3	12
2. High Polymer and Rubber Technology.	1958	1	8	2	. .
3. Fine Chemicals and Synthetic Drugs.	1958	1	8	2	. .

It conducts research mainly on catalysis at high temperatures and pressures, kinetics of reactions of high-polymers, rubber, drugs and complex compounds.

Staff: The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
1. *Academic*		
Professor	1	1
Assistant Professors	3	3
Lecturers	4	3
Assistant Lecturers	7	5
Senior Research Assistants	3	2
Junior Research Assistants	6	3
2. *Technical*	5	5
3. *Supporting*		
(*a*) Ministerial	2	2
(*b*) Class IV	8	8
TOTAL	39	32

The Department has at present 13,000 sq. ft. of accommodation out of which about 6,000 sq. ft. is used primarily for undergraduate teaching and the remaining is used for the post-graduate and research work. The rubber laboratory of the Department occupying about 1,000 sq. ft. is at present housed in the Department of Civil Engineering.

Equipment: The Department has got equipment costing about Rs. 5 lakhs out of which equipment worth Rs. 1 lakh is used for the undergraduate and research work.

Operating cost: The Department gets an operating annual grant of Rs. 35,000.

Other activities: The Department does some consulting and research work for industry and other organisations.

Proposals: The Department has requested for an additional accommodation of 3,600 sq. ft., 1,650 sq. ft. for undergraduate work, 1,000 sq. ft. for rubber technology section at present located in the Department of Civil Engineering and the remaining for providing for the new post-graduate courses in:

(i) Paper Technology; and

(ii) Glass and Ceramics and for starting a three months' introductory course in Nuclear Chemistry.

There is also a request for providing Rs. 2·5 lakhs for equipment. Out of this, equipment worth about Rs. 50,000 is required for undergraduate work in Physical Chemistry. The remaining equipment is required for the existing post-graduate courses and research work. In addition there is a request for Rs. 4·0 lakhs for new post-graduate courses.

The Department has requested for the following additional staff:—

(A) For consolidation of the present activities

(a) Senior Professor	1
(b) Assistant Professor	1
(c) Assistant Lecturer	1
(d) Senior Research Assistant	1
(e) Junior Technical Assistants	2
(f) Laboratory Attendants	2

(B) For starting new post-graduate courses and an introductory course in Nuclear Chemistry:

(a) Assistant Professors
(b) Lecturers
(c) Junior Technical Assistants
(d) Laboratory Attendants

Committee's Observations

The Department has an appreciable amount of good research work to its credit particularly in the field of catalysis at high temperature and pressure. In regard to the proposals for instituting additional post-graduate courses, the Committee feel that since the sister institute at Bombay is organising a full-fledged Department of Silicate Technology and as this subject is taught in some of the existing University Departments, it would be advisable to postpone it at Kharagpur for the time being. Similar considerations would apply to the proposal for Paper Technology in view of the existing facilities at the Forest Research Institute, Dehra Dun. With regard to the short-term introductory course in Nuclear Chemistry, the subject being of special interest to the requirements of the Department of Atomic Energy and the existing teaching departments of Nuclear Physics in some of the Indian Universities, it would be advisable to consult in the first instance that Department before instituting such a course.

In view of the above, the Committee do not think that any staff in addition to that already sanctioned is necessary, particularly in view of the much lower intake of post-graduate students that is now provided for. One of the main recommendations of the Committee is that the teaching of basic sciences to the undergraduates needs further elaboration both in content and scope. The Committee are not in a position to assess precisely as to what extent the additional teaching load can be borne by the sanctioned staff. This should be examined before additional staff is considered for increased post-graduate and research work.

It is suggested that additional accommodation to the extent of 4,000 sq. ft. may be provided, 1,000 sq. ft. for Rubber Technology

Laboratory at present housed in the Department of Civil Engineering. 2,000 sq. ft. for undergraduate teaching and 1,000 sq. ft. for relieving congestion in the existing laboratories.

Regarding equipment, a sum of Rs. 100,000 may be provided for essential undergraduate and research work.

Department of Chemical Engineering

109. The Department of Chemical Engineering was started in 1951 and the undergraduate course was instituted in 1956. The total number of students in the undergraduate and post-graduate course is given below:—

1. *Undergraduate course*

Course of study	Started in	Duration	Present intake capacity	Present strength 1st, 2nd, 3rd, 4th	Total	Number passed till 1958
Chemical Engineering	1956	4 years	15	16 13 13 ..	42	..

2. *Post-graduate course*

Course of study	Started in	Duration	Present intake capacity	Present strength	Number passed till 1958
(*a*) Combustion Engineering and Fuel Economy	1952	1 year	8	10	31
(*b*) Chemical Plant Design and Fabrication	1957	1 year	8	10	8

It conducts research mainly on activities of non-ideal solutions, fluidised carbonisation and gassification of coal, extraction of vegetable oils, study of Fischer Tropsch synthesis, Design of Reactors for Vapour Phase, Oxidation of Hydrocarbons and of Ejectors and Motion of Liquid Drops in Immersible Liquids.

In addition, there are two research schemes on Atomization of Fluids and Extraction and Utilisation of Sugar Cane Wax, sponsored by the Council of Scientific and Industrial Research and the Union Ministry of Food and Agriculture, respectively.

Altogether, there are at present 10 research scholars working in the Department.

The position of sanctioned and existing staff is given below:—

Staff	Sanctioned	Existing
Academic Staff		
Senior Professor	1	..
Professor	1	1
Assistant Professors	3	3
Lecturers	4	3
Assistant Lecturers	3	3
Senior Research Assistants	3	3
Junior Research Assistants	2	2
Technical Staff		
Foreman	1	1
Mechanic Gr. A	1	1
Mechanic Gr. B	1	1
Mechanic Gr. C	1	1
Laboratory Attendants	11	11
Temporary Staff for Fischer Tropsch Project		
Erection Engineer	1	..
Chemical Engineers	4	1
Technical Assistants	3	3
'A' Grade Mechanics	5	5
Draftsman	1	..
Plant Operators	2	..
Laboratory Helpers	4	4

Space: The Department has at present 22,340 sq. ft. of accommodation.

Equipment: The Department has also got equipment costing about Rs. 11 lakhs.

Operating Cost: The annual operating expenditure of the Department is Rs. 40,000.

Other activities: The Department does some consulting for research work for the industry. It operates a liquid air plant and an oxygen plant for meeting the requirements of the entire Institute.

Pilot Plant: A pilot plant of the Fischer Tropsch type for the production of 100 gallons of liquid fuel per day has been designed and constructed by the Department and is expected to be in operation shortly. It will be used for imparting training to post-graduate students mainly on the problems of design, instrumentation, operation and control.

Proposals: The Department has proposed increased intake of undergraduates and introduction of Petroleum Chemical Technology and Coal Chemical Technology in this course. Further, it has suggested the introduction into the post-graduate course of two new subjects, namely Petroleum Chemical Technology and Coal Chemical Technology. Based on these, it has requested for additional accommodation of 5,600 sq. ft. and equipment worth about Rs. 1,25,000.

The requirements of additional staff are:—

Assistant Professors	2
Lecturers	2
Assistant Lecturers	2

Further, to ensure regular production of liquid air and oxygen and to run the Fischer Tropsch Plant for training purposes, it has asked for the following maintenance staff:—

Technical Assistants	3
Mechanics Grade 'A'	6
Mechanics Grade 'B'	2
Laboratory Attendants	3

on the understanding that the temporary staff at present engaged for its fabrication and erection would be dispensed with after its commissioning.

Committee's Observations

The Department has made commendable efforts in organising courses particularly in view of the difficulty of lack of proper buildings and the necessity for fabricating a considerable amount of equipment. More space and equipment is required even for consolidating its present activities. Its proposals for additional space and equipment appear to be reasonable.

In regard to the introduction of new subjects of Petroleum Chemical and Coal Chemical Technology in undergraduate and post-graduate courses, the Committee feel that in view of the Department not yet having produced even the first batch of graduates, the proposal may be examined when it has consolidated its present activities. There is at present an urgent need of initiating teaching in furnace designing for which practically no facilities exist in the country. It is suggested that teaching in the subjects of Combustion Engineering and Fuel Economy may be arranged so as to include some treatment of this subject, particularly in view of some initial work having already started in the Department.

In the light of the above observations, the Committee do not feel the need of staff in addition to what has already been sanctioned, but are inclined to agree to providing the maintenance staff for running the Fischer Tropsch Plant. The Committee are of the opinion that there is a danger of this plant dominating the post-graduate thinking of the Department and suggest that care should be taken to avoid this eventuality.

Department of Civil Engineering

110. The Department of Civil Engineering was started in the year 1951 and the undergraduate course was started in the year 1951. The duration of the course is four years and the present annual intake capacity is 100. The total number of students in the undergraduate course is at present 398. Year-wise figures are also given below:—

1st year	107
2nd year	93
3rd year	102
4th year	96

The first batch of students graduated in the year 1955 and so far 345 students have passed the undergraduate course.

The Department conducts post-graduate courses in:

	Intake capacity	Present strength
1. Structural Engineering	8	7
2. Dam Construction and Water Power Engineering	8	6
3. Highway Engineering	6	3
4. Soil Mechanics and Foundation Engineering	6	6
5. Municipal Engineering	8	2
6. Harbour Engineering	8	..

The annual intake capacity for each of the post-graduate courses and the number of students at present admitted to the course are shown against each course:

It also conducts research in the fields of—

- (i) Strength and behaviour of deep beams (concrete)
- (ii) Strength of encased steel structures
- (iii) Collection of data regarding geotechnical properties of Indian soils
- (iv) Shear strength of concrete beams
- (v) Temperature stresses in concrete pavements
- (vi) Soil suction characteristics
- (vii) Mechanics of sediment transportation and scour
- (viii) Volute syphons

At present there are two Research Fellows working in the Department.

Staff: The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
A. Academic		
Senior Professor	1	1
Professor	3	2
Assistant Professor	8	10
Lecturer	16	10
Assistant Lecturer	22	14
Instructors	6	2
Senior Research Assistants	2	1
Junior Research Assistants	2	2
B. Technical		
Technical Assistants	4	..
Draughtsman	1	1
Mechanic Grade 'A'	3	1
Mechanic Grade 'B'	5	..
Mechanic Grade 'C'	2	4
C. Ministerial		
Lower Division Clerk	1	1
D. Other Staff		
Laboratory Attendants	9	9

The Department has at present 44,270 sq. ft. of accommodation of which 22,945 sq. ft. are used primarily for undergraduates and 21,325 sq. ft. for post-graduate and/or research work.

The Department has also got equipment costing Rs. 15,93,096. The equipment costing Rs. 8,70,158 is used for the undergraduate course and the equipment costing Rs. 7,22,938 is used for post-graduate and/or research work.

Operating Cost: The Department gets an operating annual grant of Rs. 25,000.

Other activities: In addition to the undergraduate and research work, the Department is doing consultative and research work for industry and other organisations.

Proposals: The Department has now requested for additional accommodation of 4,660 sq. ft., 2,160 sq. ft. will be required for undergraduate work and 2,500 sq. ft. for post-graduate and/or research work.

There is also a request for equipment costing Rs. 65,000. The equipment costing Rs. Nil will be required for undergraduate and equipment costing Rs. 65,000 for post-graduate and/or research work.

The additional staff requested is—

Senior Professor	I
Professor	I
Assistant Professors	4
Lecturer and Assistant Lecturer	Reduction of 5 Nos.

Committee's Observations

This Department is doing very good work at both the undergraduate and post-graduate levels. The sanctioned number of teaching staff is 50, excluding Instructor and Research Assistants, who do not have degrees in Engineering. As against this there are 37 actually appointed. It is considered very desirable to second, for a period of 2 to 3 years, practising engineers from the State or Central Government services, who have had considerable experience as Construction Engineers, Projects Designers etc. This will vitalise teaching and bring the Institution into closer contact with the profession. The Institution should prepare a panel of suitable men and a request be made to the employing authority for giving on loan the services of members on this panel.

There are three post-graduate courses, *viz.*, Municipal Engineering, Harbour Engineering and Highway Engineering, which do not appear to be at all popular. Perhaps this Institution is not altogether a suitable place for these courses. In Calcutta, the Institute of Hygiene and Public Health is well established and has been conducting post-graduate courses in Municipal Engineering for many years. The subject of Harbour Engineering would be more appropriate to one of the other institutes whose location would have a distinct advantage in the matter of Harbour studies. Highway Engineering is adequately provided for elsewhere, and in any case Kharagpur is not a suitable location for it. The Committee, therefore, recommend that Municipal Engineering, Harbour Engineering and Highway Engineering may be omitted from the list of post-graduate studies. Not much progress has been made in equipping these laboratories.

There is room for a fuller development of the undergraduate courses in Structural Engineering, Hydraulic Engineering and Soil Mechanics branches. There is also a demand for post-graduate training and the following Departments are, therefore, suggested:—

Proposed post-graduate courses of study in Civil Engineering.

Group I—Structural Engineering

(i) Structural Analysis and Steel Design;
(ii) Structural Analysis and Concrete Design
(iii) Structural Theory and Research

Note.—(i) and (ii) will also have to do a research thesis of applied nature and that of (iii) will be of more fundamental nature.

Group II—Hydraulic Engineering

(i) Dam Design and Construction.
(ii) Irrigation and Water Power

Group III—Soil Mechanics and Foundations Engineering

(i) Soil Mechanics and Foundations

(ii) Structures and Foundations

The introduction of these Groups would not involve any additional expenditure.

In the proposals of the Department 2,160 sq. ft. area is asked for staff room and 2,500 sq. ft. for the post-graduate courses in Harbour and Municipal Engineering. The Department has ample space as it is and it is not considered necessary to provide this additional space. The Department intends to purchase equipment worth Rs. 65,000 for Municipal and Harbour Engineering. In view of the remarks for abolition of the post-graduate courses in Municipal and Harbour Engineering, this equipment need not be purchased. The request for additional staff is based on the intention to create two major sections in the Department—one for the Hydraulics Group of subjects and the other for the structures group and proposes, therefore, to create a second post of Senior Professor. This demand is not supported by the Committee.

The present students of the Department comprise 398 undergraduates and 24 post-graduates. For this the total teaching staff available is 37. If the undergraduate intake is reduced to 45 per year, there may be some surplus of staff. Should the proposals for reducing the intake not be implemented, it will be necessary to augment the existing teaching staff of 37 to a certain extent.

Department of Electrical Engineering

111. The Department of Electrical Engineering was started towards the end of 1951 for the training of undergraduates. The duration of the course is four years and the present annual intake capacity is 75. The total number of students in the undergraduate course is at present 270. Year-wise figures are given below:—

1st year	75
2nd year	70
3rd year	65
4th year	60
TOTAL . . .	270 (approximate)

The first batch of students graduated in the year 1955 and so far 185 (approximately) students have passed the undergraduate course.

In addition the Department provides undergraduate teaching to 410 students of sister departments where Electrical Engineering is a subsidiary subject.

The Department conducts post-graduate courses in the following subjects and the annual intake capacity for each of these courses and the number of students at present admitted to each course are given:

	Started in year	Present intake capacity	Present strength	Number passed till 1958
Electrical Machine Design	1955	8	6	19
Control System Engineering	1958	8	2	Nil

In addition, training is given to 20 post-graduates of other departments who are taking Electrical Engineering as a subsidiary subject.

The Department also conducts research in Electrical Machine Design and Performance and has developed a solid iron type rotor for a squirrel cage induction motor.

At present there are two Research Scholars working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
(*i*) Teaching	21	18
(*ii*) Technical	8	7
(*iii*) Ministerial	1	1
(*iv*) Class IV	6	6

The Department has at present 25,850 sq. ft. plinth (18,865 sq. ft. net) of accommodation, of which 13,640 sq. ft. (net) are used primarily for undergraduates and the remainder for post-graduate work, and for the Workshop and Instrumentation.

The Department has equipment costing Rs. 7,78,000 of which equipment to the value of Rs. 6,18,000 is used for undergraduate courses and the remainder valued at Rs. 1,60,000 is used for post-graduate and/or research work.

Operating cost: The Department gets an operating annual grant of Rs. 35,000.

Other activities: One member of the staff is a member of the Electrical and Wind Power Research Committee, Council of Scientific and Industrial Research and a member of the Staff Selection Board tronics and Communications is considerably overstaffed. In the opinion of the Committee the latter subjects should be regarded as an miners for various technological institutes in the country both at undergraduate and post-graduate levels. The Department helps the Central Public Works Department in an advisory capacity in the installation and maintenance of electric and water supplies to the Institute.

Proposals: The Department has now requested additional accommodation of 14,000 sq. ft. (net) (19,600 sq. ft. plinth). Of this, 5,400 sq. ft. will be required for undergraduate work, 5,000 sq. ft. for post-graduate and 1,350 sq. ft. additional space for Workshop and Instrumentation to facilitate research.

There is also a request for additional equipment costing Rs. 6,05,000 The equipment costing Rs. 1,77,500 is required for undergraduate work and equipment costing Rs. 4,27,500 for post-graduate and/or research work.

The additional staff requested is:

Professor	2
Assistant Professor	4
Research Officer	1
Lecturer	2
Senior Research Assistants	1
Junior Research Assistants	1
Mechanic Gr. 'A'	3
Mechanic Gr. 'B'	2
Laboratory Attendants	2

The Department proposes that out of Rs. 5,000 in the operating annual grant should be restored and the present annual grant of Rs. 35,000 be raised to the former figure of Rs. 40,000.

Out of the proposed expenditure of Rs. 4,27,500 on post-graduate work, the largest items are:

Rs. 1,15,000 for a frequency and voltage stabilised 30 KW Motor/Alternator Set; Rs. 69,000 for machines and a supply transformer for a new proposed post-graduate machine laboratory and Rs. 1,28,000 for machine tools for an Electrical Machine Design Workshop.

It is hoped to start, in the near future, two more post-graduate courses, one on Power System Engineering and the other in Electric Traction and Illumination.

The Department has two members of the teaching staff at present away on study leave and also three members short of its sanctioned quota. The teaching load is heavy and the student/teacher ratio is rather high. The two Senior Research Assistants are, therefore, required to carry out teaching duties far in excess of what is normally expected of them.

Committee's Observations

The Department of Electrical Engineering is at present somewhat understaffed. On the other hand, the associated Department of Electronics and Communications is considerably overstaffed. In the opinion of the Committee the latter subjects should be regarded as an integral part of Electrical Engineering at the undergraduate stage, and the staff of the Electronics and Communication Department should play a more considerable part in the early stage teaching in Electrical Engineering in addition to its specialist contribution in the final year. The overall sanctioned teaching strength of the two departments should be adequate for undergraduate purposes but some addition to the present Electrical Engineering staff will be necessary as the post-graduate work develops.

Space for additional Electrical Engineering Departmental activities should also be found within the combined departments.

The Committee regard a sum of Rs. 3 lakhs as sufficient for new equipment. The Department has asked for Rs. 6,05,000 but the Committee feel that a reduction of Rs. 1,77,500 can be effected in the undergraduate equipment requirement which, in the Committee's view, is adequately met by the existing equipment. The Committee also recommend the omission of an amount of Rs. 1,28,000 required for equipping an Electrical Machine Design Workshop; the Committee are of the opinion that this would segregate in the Electrical Engineering Department equipment which would be better located in the Central Workshop.

Department of Electronics and Electrical Communication Engineering

112. The Department of Electronics and Electrical Communication Engineering was started at the end of 1951 with one Professor, one Lecturer and four supporting technical staff. Initially it was decided that only post-graduate courses should be given of differing length according to the type of student intake but later it was suggested that the countrywide demand for Electrical Communication Engineers could only be met by the institution of four year undergraduate courses. In the year 1954, when the present Director took office, it was decided that the Department should run both undergraduate and post-graduate courses.

The duration of the undergraduate course is four years and the present annual intake capacity is 20. The total number of students in the undergraduate course is at present five. Year-wise figures are given below:—

1st year	Nil
2nd year	Nil
3rd year	Nil
4th year	5

The first batch of students graduated in the year 1956 and so far 21 students have passed the undergraduate course.

In addition the Department provides undergraduate instruction in Applied Electronics (to 4th year Electrical Engineering students). principles of Electrical Communication (3rd year Electrical Engineering students) and Basic Electronics (3rd and 4th year students of different other departments).

The Department conducts post-graduate courses in Radio Broadcast Engineering, U.H.F. and Microwave Engineering, and Industrial Electronics. The annual intake capacity for each of the post-graduate courses and the number of students at present admitted to the course are shown in each case:

Course	Started in year	Present intake capacity	Present strength	Number passed up to 1958
Radio Broadcast Engineering	1955	4	3	11
U.H.F. & Microwave Engineering.	1957	4	2	3
Industrial Electronics	1958	4	2	Nil

In addition the Department conducts post-graduate courses in Election Tubes and Circuits for the Geology and Geophysics Department (an average of five students per course) and in Vacuum Tubes, Electronic Circuits and Applications for 10 students taking a post-graduate course in Control System Engineering in the Electrical Engineering Department.

Two members of the staff have registered for the Ph.D. degree and one has submitted a thesis for D.Sc. One staff member has registered for the D.Phil. degree in Calcutta University and one external candidate has registered for a Ph.D. through this Department.

There are two Research Scholars working in the Department, but one has recently become a Senior Research Assistant. There were four Senior Research Assistants, out of whom three have recently become Lecturers.

The position of sanctioned and existing staff is as follows:—

	Sanctioned	Existing
Head of the Department . .	1	1
Professor	1	..
Assistant Professor	3	3 (one on study leave)
Lecturer	3	2 plus 3
Senior Research Assistants .	4	4—3
Instructor	2	..
Technical Assistant	2	2
Foreman	1	1
Mechanic Gr. 'A'	3	3
Mechanic Gr. 'B'	3	2
Mechanic Gr. 'C'	3	3
Mechanic Gr. 'C' (Telephones)	6	5
Lower Division Clerk . .	1	1
Laboratory Attendant . .	3	3

The Department has at present 17,400 sq. ft. net (20,700 sq. ft. gross) of which 6,000 sq. ft. is primarily for undergraduate teaching and 8,000 sq. ft. for post-graduate training and research, the remainder being available for workshop stores, office etc.

The Department has equipment costing Rs. 11,70,000 of which equipment to the value of Rs. 2,50,000 is used primarily for undergraduates and Rs. 6,55,000 is used for post-graduate and/or research work. In addition the Department has equipment worth Rs. 80,000 such as projectors, telephone equipment etc. which is used by all Departments and Rs. 1,75,000 worth of stores in the shape of spares.

Operating cost: The Department gets an operating annual grant of Rs. 30,000.

Other activities: In addition to normal academic work this Department has to look after the maintenance and operation of the telephone system of the Institute campus, Public Address System and Cine Projectors, Radio Receivers and servicing of some electronic equipment of other departments as well. The Department is occasionally approached by outside departments needing help which is freely given. Last year, training in Electronics was given to a technician from the Government Food and Nutrition Laboratory and advice was given on Aerial Problems to the Air Force Station at Kalaikunda.

Proposals: The Department has not requested any further space.

There is a request for spare components, all of comparatively small value but totalling approximately Rs. 20,000 for which dollar exchange would be required.

In addition a further quantity of components from abroad would be required, to the value of Rs. 25,000 if it is agreed that the proposed new Laboratory on Electronic Switching Circuits should be set up.

An annual grant is also requested of Rs. 15,000 per year to be spent mainly in dollar area in order to maintain existing equipment by the purchase of necessary spares and replacements.

It is suggested that an Assistant Professor, who is a specialist in Electronic Switching and Circuit Synthesis and Analysis, should be appointed.

Committee's Observations

The Committee are of the opinion that the Department of Electronics and Electrical Communications should cease to have a separate identity in respect of undergraduate work and should become an integral part of the Electrical Engineering Department for this purpose. The Department is lavishly equipped and the only significant requirement on this side is a small allocation of funds for the importation of spare parts to keep the existing equipment in satisfactory working condition. The Committee approve the proposal to establish a course on Electronic Switching Circuits but question the need for a concomitant addition of an Assistant Professor on this subject.

The Committee support the proposal that the maintenance activities of the Department in respect of Electronic and allied equipment in general use in the Institute should be transferred to a Central Instruments Service Section, but that the Professor and the appropriate members of the staff should carry the responsibilities for ensuring the effectiveness of this Service Section.

Department of Geology and Geophysics

113. The Department of Geology and Geophysics was started in the year 1951 and the undergraduate course was started in 1952. The duration of the course is three years and the present annual intake capacity is 20. The total number of students in the undergraduate course is at present 43. Year-wise figures are given below: —

1st year	15
2nd year	13
3rd year	17

In addition, the Department provides undergraduate instructions to students of Civil, Mining and Agricultural Engineering Departments and of the Department of Architecture and Regional Planning. In three years these students numbered 196.

The first batch of students graduated in the year 1954 and so far 40 students have passed the course.

The Department conducts post-graduate courses in the following subjects and the annual intake capacity for each of the post-graduate courses and the number of students at present admitted to the course are shown against each course.

	Started in	Present intake capacity	Present strength	Number passed till 1958
Applied Geology (2 years) .	1955	8	2 + 2	8
Exploration Geophysics (2 years).	1955	8	4 + 3	5
Geochemistry (1 year) .	1958	4	1	..

It also conducts research in the fields of Petrology and Minerology, Economic Geology, Structural Geology, Sedimentology, Paleontology, Groundwater Geology, Geochemistry and Geophysics.

At present, there are four Research Scholars working in the Department. Thesis for Ph.D. has been submitted by one teacher.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
(*i*) Teaching .	20 + 3 S.R.A.	18 + 3 S.R.A.
(*ii*) Technical .	10	10
(*iii*) Ministerial .	1	1
(*iv*) Class IV . .	7	7

The Department has at present 12,650 sq. ft. of accommodation, of which 7,300 sq. ft. are used primarily for undergraduate and the balance for post-graduate and/or research work.

The Department has equipment costing Rs. 10,14,000. The equipment costing Rs. 4,07,000 is used for the undergraduate course and the equipment costing Rs. 1,85,000/Rs. 4,22,000 is used for post-graduate and/or research work.

Opening cost: The Department gets an operating annual grant of Rs. 25,000.

Other activities: In addition to the undergraduate and research work, the Department has done groundwater investigation work for West Bengal Government.

Proposals: The Department has now requested for the following additional space for post-graduate work:—

Geochemistry	2,134 sq. ft.
Seismological	4,000 sq. ft.
For undergraduate work in Petroleum Geology.	1,500 sq. ft.

There is also a request for equipment costing Rs. 16,000 which will be required for consolidating existing undergraduate work and equipment costing Rs. 43,000 required for the Petroleum Geology undergraduate course (proposed).

The proposed demands for post-graduate and research equipment are as follows:—

For consolidating the already opened Geochemistry course.	Rs. 1,77,000 (of which Rs. 1,25,000 is for X-Ray apparatus which exists in the Physics Department, but does not meet the need).
For consolidating the existing other post-graduate activities.	Rs. 37,250
For post-graduate course in Seismological Engineering (not yet approved by the Advisory Committee).	Rs. 6,00,000

Committee's Observations

The Committee recommended that the equipment required for consolidating existing undergraduate work may be provided. As regards Petroleum Geology, the Committee are of the view that the Oil and Natural Gas Commission, who are the only employers, should be consulted as to their requirements in the next five years. It is not known to the Committee to what extent the existing facilities at the Indian School of Mines and Applied Geology, Dhanbad, will meet these requirements. If there is a clear indication that there will be sufficient employment potential, the proposed Petroleum Geology undergraduate course may justifiably be started. The Committee doubt the need for opening a new post-graduate course in Seismological Engineering. The Committee also hesitate to recommend any considerable expansion in the post-graduate course in Geochemistry.

Department of Humanities

114. The Department of Humanities and Social Sciences was originally started as a Section called "English and Humanities". In 1956, it was raised to the status of a full-fledged Department. The teaching programme began in 1951 with two concurrent courses for the first year—English and Civics, which included the Indian Constitution.

In July, 1952, two courses in English and History were offered in the second year class. In July, 1953, Industrial Psychology was also offered for the first time at the undergraduate level. A course in Psychology of Industrial Relations is being offered in the IV year.

The Department has also been offering a number of special courses as optionals. Courses in Elementary German, started in July, 1953, for research scholars, and teachers, evoked much interest. The Department was encouraged to offer courses in elementary German and elementary French for the undergraduates too, in July, 1954. A year later, advanced courses in the two languages were also organised. To have a graduated series of courses, Intermediate courses in the two languages were started in July, 1957. For the post-graduate students and research scholars, the Department has been holding separate language classes in the evening since October, 1957. For several months during the academic session 1957-58, classes in elementary Russian for teachers, research and post-graduate students were organised.

Elementary Hindi and Bengali were offered as "optionals" for the first year students during two academic sessions in 1955—57. At present Hindi is offered as an "optional" at the second year stage. Since December this year, special evening classes in it have been organised to enable non-Hindi speaking members of the staff and students to learn the language. The Department has been offering a number of courses like Literary Appreciation, Advanced Economics and Indian Renaissance as 'optional'.

For promoting the knowledge of foreign languages and cultures, the Foreign Languages Association was inaugurated in February, 1958.

A post-graduate diploma course in Industrial Psychology and Industrial Relations was offered for the first time in the beginning of the current session. Students with a degree in Engineering or a Master's degree in Economics or Psychology are admitted to the course.

Besides teaching, the Department aims at developing research in areas of the human aspects of work, the industry, and the engineering profession generally.

All students have to take the compulsory subjects along with optionals. The existing teaching load is given below:—

I. Existing teaching load per week

	Under-graduate	Post-graduate	Research guidance	Total
(*a*) For the Deptt. . .	..	10+4*	15	29
(*b*) For other Deptt. .	162	1	..	163
		TOTAL . .		192

*Post-graduate teaching in courses run by other Departments

Note.—No undergraduate students are assigned to this Department.

II. For additional courses proposed to be started

	Under-graduate	Post-graduate	Total
(*a*) For the Deptt. . . .	*	14	14
(*b*) For other Deptt. . .	..	2	2
	TOTAL . .		16

Note: *This does not take into account the proposed Five-Year Integrated Course for which the total teaching load for the Department in the undergraduate classes is estimated to be 342 hours per week for an increase of 400 students, and 292 hours per week for an increase of 320 students.

The starting of an one-year diploma course in Industrial and Labour Economics has been suggested by this Department.

The enrolment sanctioned for the post-graduate course is eight. The students on roll are two.

The Department conducts research in the following fields:—

(i) Changes in value following accelerated industrialisation;

(ii) Legibility of printed material in Devnagri script;

(iii) Personality characteristics of high and low achievers in Engineering courses;

(iv) Construction and standardisation of certain personality tests, suitable for use on students as well as workers.

Apart from these, the study of "Organisational Control in a Railway Workshop" is being carried on with funds amounting to Rs. 12,000 received from the Asia Foundation.

At present there are two Research Scholars working in the Department.

The position of sanctioned and existing staff is given below:—

Present position (up to 27-11-1958)

Cadre	*Sanctioned*	*Filled*
Professor	1	..
Assistant Professor	1	1
Lecturers	7	7
Assistant Lecturers	7	7
Instructors	2	2
Technical Assistant	1	1
Lower Division Clerk	1	1
Attendant (Gr. II)	1	1
TOTAL	21	20

The Department has at present 3,000 sq. ft. of accommodation for staff members, post-graduate students and laboratories.

The Department has also got equipment costing Rs. 21,000 approximately, used mainly for the undergraduate course.

Operating Cost: The Department gets an operating annual grant of Rs. 5.000.

Other Activities: In addition to the undergraduate and research work, the Department has been participating in the teaching in certain post-graduate courses run by sister Department, *viz.* Economics and Personnel Management to the M. Tech. course in Industrial Engineering, and Sociology and Economics to the diploma course in Architecture and Regional Planning.

Proposals: The Department has now requested for additional accommodation of 2,400 sq. ft.

There is also a request for (a) equipment costing Rs. 20,000. Equipment costing Rs. 10,000 will be required mainly for undergraduate and equipment costing Rs. 10,000 mainly for post-graduate and research work; (b) a grant of Rs. 5,000 for books and journals in addition to the grant of Rs. 2,000 already being given; (c) an additional grant of Rs. 500 in the recurring operating grant of Rs. 5,000; and (d) a provision of Rs. 2,000 for a guest-lecture scheme.

The additional staff requested is:

(1) An Assistant Professor.

(2) A Lecturer in Philosophy in the scale Rs. 350—850.

(3) A Lecturer in Industrial and Labour Relations in the scale Rs. 350—850.

(4) Upgrading of one of the posts to the cadre of Assistant Professor for the Psychology Section.

(5) A Lecturer in Economics.

(6) A Psychometrician (in Senior Research Assistant grade).

(7) A Laboratory Attendant for the Psychology and Languages Laboratories.

(8) A part-time Mechanic in Grade B.

Committee's Observations

This is not the place to discuss the fundamental question whether Humanities courses should be designed to acquaint the student of technology with normal and aesthetic values, the significance of ideas and the criteria and methods of the Humanities, or merely to widen his information and interest and qualify him better socially for the type of work he is likely to do as a technologist. The utilitarian point of view cannot be ignored, but if too much emphasis is placed upon it, the result may be superficiality. A proper understanding of humanistic values, on the other hand, assumed an aptitude for appreciating them which a technologist may or may not possess. It would be advisable to make the Humanities courses as comprehensive as possible, having regard to the time that can be reasonably allotted to them in an Institute of Technology.

The purpose of the Humanities courses may thus be defined as:

(1) Giving information about current affairs and significant social and political movements;

(2) Improving the technologist's efficiency as a responsible member of his society;

(3) Broadening his knowledge by giving him a proper historical and contemporary perspective of the social role of technology; and

(4) Stimulating the desire to understand and give their proper place in his ideology to moral and aesthetic values.

In the courses being offered at present in the Institute, the last two aims might well be brought more to the foreground. In the first two, the students have shown considerable interest. The language courses have also been an attraction. But although the Humanities Department takes technology students through prescribed or selected courses, it appears to have worked in isolation from the technological departments. The Advisory Committee of the Department is also very small, and none of the fundamental sciences or the primary technologies is represented on it.

It is desirable that the existing courses should be revised by a committee on which humanists, social scientists and technologists should be equally represented, at least half of them members of the Institute's own staff, and that more time should be provided for Humanities in the third and fourth years. The Committee on courses should be specially requested to draw up syllabuses of the history of science and technology, and the Institute might then seek to assign to competent persons on its own staff the task of preparing books for teaching along the lines indicated in the syllabus. This would fulfil a national need, and should be given far greater importance than what is conventionally called research. As an important function, the Humanities Department must undertake the provision of instruction and guidance to technology students in the matter of the preparation of their project report, research papers and general technical report writing. This would necessarily involve closer co-operation between the Departments of Technology and the Department of Humanities.

The questions of courses, undergraduate and post-graduate classes and staff are interdependent. Since some courses are compulsory, all the undergraduate students have to be taught at the same time in different sections. When the basic questions of enrolment and the integrated five-year course have been decided, the matter of additional lecturers may be considered. At the present time, some teachers have to repeat the same lectures in different sections every day, and complain with good reason that this has a deadening effect. This should in any case be avoided, either by redistribution of work or by additional appointments. It is essential that the post of professor to head the Department should be filled.

The Department needs more accommodation, but this question should be taken up, if necessary, after the new wing has been added to the present building, where the Department has been allotted some space.

The equipment asked for is in accordance with the requirements of the existing courses.

Some of it is for purposes of psychological research, some in order to make language teaching more efficient, both at the undergraduate and at the post-graduate level. The total amount required is Rs. 20,000. About half of this may be sanctioned at once to improve the teaching in the undergraduate and some post-graduate classes. The remainder may also be sanctioned if recommended by the Committee for revision of courses suggested above.

The following additional grants may also be approved:

For books and journals	Rs. 5,000
Recurring grant	Rs. 800
For Guest-Lecturer Scheme . . .	Rs. 2,000
	Rs. 7,800

Department of Mathematics

115. The Department of Mathematics was set up in 1951 with six teachers including a Professor of Applied Mathematics as its head. The main function of the Department is to provide teaching of

Mathematics and Statistics, with special reference to engineering applications, to students of various engineering courses both at the undergraduate and post-graduate level.

The Department offers two post-graduate courses in:

(a) Non-linear Mechanics (since 1957)

(b) Plasticity and Rheology

Two students have passed in the first of these and five other students are taking the course at present. There has been no intake up-to-date in the second course.

The Department also conducts research in the fields of: Fluid Mechanics, Elasticity, Relativity, Numerical Mathematics, Geometry, Statistics, Operations Research, Astrophysics.

During the period 1951-58 about 126 papers have been written of which 96 have already been published. Seventeen members of the Department have obtained their Ph.D. degree from different Universities during the period 1955-58.

At present there are nine Research Scholars working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
Professor	1	1
Assistant Professors	3	3
Lecturers	6	6
Assistant Lecturers	12	12
Junior Technical Assistants	3	3
Mechanic	1	1
Clerk-Typist	1	1
Laboratory Attendants	2	2

The Department has at present 4,098 sq. ft. of accommodation of which 2,800 sq. ft. are used, primarily for undergraduates and the remainder for post-graduate and/or research work.

The Department has equipment costing Rs. 4,08,000 of which equipment worth Rs. 1,28,000 is used for undergraduate work and Rs. 2,80,000 worth is used for post-graduate and/or research work.

Operating Cost: The operating grant of the Department is Rs. 10,000 per year.

Other Activities: A small Electronic Analogue Computer has been made, and a model construction Laboratory is available in which a large number of mathematical and statistical models have been prepared for display and class-room demonstrations.

Several members of the staff are members of various Committees connected with Government departments and Teaching and Research Institutes.

Proposals: The Department has requested the provision of additional accommodation of 4,800 sq. ft. of which 3,400 sq. ft. would be required for undergraduate work and 1,400 sq. ft. for post-graduate and/or research work. This will be met by the provision of 10,000 sq. ft. in the extension to the North Wing now under construction, which will be sufficient also to replace the space at present occupied.

In addition a request for 3,000 sq. ft. has been made for a Computer laboratory.

There is also a request for equipment costing Rs. 4,60,000 of which Rs. 40,000 is required for undergraduate work and Rs. 4,20,000 for making and housing a digital computer for post-graduate and/or research purposes.

The additional staff requested is:

Teaching—8 (including 1 Senior Professor and 2 Professors).
Other staff—3.
Computational Laboratory—15 (5 academic and 10 others).

Committee's Observations

The proposal to set up a Computation Laboratory to house the existing "EASE" Analogue Computer and the proposed Digital Computer may be accepted.

The Committee recommend that a Digital Computer should be built rather than bought from abroad and further recommend that serious consideration be given to making this a duplicate of the computer now being developed in the Tata Institute of Fundamental Research at Colaba, Bombay. This procedure would have the merit that programme routines could be freely exchanged between the two centres which would not be possible if Kharagpur were to develop a machine using a different logic to that at Colaba.

The Committee also consider that increased accommodation, within the sanctioned space, should be allotted to the activities of the Statistics Section, and that adequate staff should be associated with these activities.

The Committee suggest that the staff and further equipping of the Department should be re-examined in the light of (a) the recommended reduction in undergraduate intake to the various Engineering Departments, and (b) the increased demand likely to fall on the Department through an extension of Mathematics teaching to later years of the undergraduate courses and to the suggested expansion of the statistics and computational activities.

As the services of the Department to other departments in the fields of statistics and computation will tend to increase in the future, the operating annual grant to the Department should be adjusted accordingly.

The Reviewing Committee received a counter-proposal that Statistics and Computation should be separated from the Mathematics Department and be made independent. The Committee do not support this proposal.

Department of Mechanical Engineering

116. The Department of Mechanical Engineering was started in the year 1950 and the undergraduate course was started in the year 1951. The duration of the course is four years and present annual intake capacity is 75. The total number of students in the undergraduate course is at present 307. Year-wise figures are also given below:—

1st year	89
2nd year	72
3rd year	74
4th year	72
TOTAL	307

The first batch of students graduated in the year 1955 and so far 232 students have passed the undergraduate course.

The Department conducts post-graduate courses in:—

(*i*) Production Technology	Started in 1952
(*ii*) Industrial Engineering	Started in 1953
(*iii*) Mechanical Handling	Started in 1954
(*iv*) Mechanism and Vibration	Started in 1955
(*v*) Machine Design	Started in 1956
(*vi*) I.C. Engine and Gas Turbine	Started in 1957
(*vii*) Refrigeration and Air-Conditioning	Started in 1957
(*viii*) Foundry Engineering	Started in 1958

The annual intake capacity for each of the post-graduate course and the number of students at present admitted to the course are shown against each course:—

	Capacity	Admitted
(*i*) Production Technology	8	9
(*ii*) Industrial Engineering	8	9
(*iii*) Mechanical Handling	8	3
(*iv*) Mechanism & Vibration (suspended at present)	4	..
(*v*) Machine Design	4	1
(*vi*) I. C. Engines & Gas Turbine	8	2
(*vii*) Refrigeration and Air-Conditioning	4	2
(*viii*) Foundry Engineering	20	6
TOTAL	60	32

It also conducts research in the fields of:

Kinematics, Machine Dynamics, Experimental Stress, Analysis, Solid Friction, Bearing, Fluid Mechanics related to Turbo-Machinery (Hydraulics and Aero-dynamics), Heat Transfer studies applied to Refrigeration Plants, Solid and Liquid Fuel Combustion, Gas Dynamics related to Propulsion, Machine Tool Dynamics, Cutting Tools, Moulding Bands, Operational Research.

At present there are no research scholars working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
Professors	6	2
Assistant Professors	9	8
Lecturers	19	18
Assistant Lecturers	15	6
Instructors	5	2
Senior Research Assistants	6	3
Technical Assistants	6	3
Foremen	2	2
Mechanic Grade 'A'	2	2
Mechanic Grade 'B'	4	4
Mechanic Grade 'C'	5	6
Laboratory Attendants	17	15
Lower Division Clerks	3	3
Draftsmen	4	3

The Department has at present 40,880 sq. ft. of accommodation of which 25,000 sq. ft. are used primarily for undergraduates and 15,880 sq. ft. for post-graduate and/or research work.

The Department has equipment costing Rs. 15,71,000. The equipment costing Rs. 3,80,000 is used for the undergraduate course and the equipment costing Rs. 11,91,000 is used for post-graduate and/or research work.

Operating Cost: The Department gets an operating annual grant of Rs. 40,000.

Other Activities: In addition to the undergraduate and research work, the Department is doing consultative and research work for industry and other organisations, and conducts residential and short-term courses for the industrial and technical personnel.

Proposals: A building measuring about 30,000 sq. ft. has already been sanctioned. The Department has now requested for additional accommodation of 16,000 (10,500 + 5,500) sq. ft. 7,000 sq. ft. will be required for undergraduate work and 9,000 sq. ft. for post-graduate and/or research work.

There is also a request for equipment costing Rs. 7,97,000. The equipment costing Rs. 1,35,000 will be required for undergraduate and equipment costing Rs. 6,62,000 for post-graduate and/or research work.

The additional staff requested is :—

Senior Scientific Officers	5
Assistant Professors	2
Lecturer	1
Office Technical Assistant . . .	1
Upper Division Clerk or Stenographer .	1

Committee's Observations

The Machine Tool equipment requested is intended primarily for post-graduate and research work in Production Technology but would also be used by those undergraduates who offer an elective in Production Technology.

The request of Rs. 1,75,000 for this equipment is therefore supported, but the Committee do not approve the proposals for the institution of a separate first degree in Production Techonology which they regard essentially as a post-graduate study to following a period of industrial training and experience.

Additional space is requested in a new building for undergraduate courses in Mechanical Engineering; for Drawing and for Fluid and Applied Mechanics for second year students generally; for Strength of Materials and Machine Design for 3rd year students of Electrical, Agricultural Design for 3rd year students of Electrical, Agricultural and Chemical Engineering and for Steam Power and I.C. Engines for 3rd year Electrical and Civil Engineering students. In addition space is required for Workshop Theory for undergraduate students generally and for the post-graduate course work of the Department. The Committee are satisfied that the total departmental space required is about 48,000 sq. ft. (plinth area) in addition to the Steam, Hydraulic Machines and Mechanical Handling Laboratories which will remain in their present sheds.

A new building, now under construction, will provide 33,000 sq. ft. and the Committee recommend that an additional 15,000 sq. ft. be made available.

In view of the proposed reduction of the undergraduate annual intake from 75 to 50, the Committee consider the present sanctioned staff to be adequate.

The reduction in the intake from 75 to 50 will not substantially reduce the annual operating expenditure. On the other hand, the full working of the new Foundry Section, the Gas Turbine Section and the new Frazer Boiler, will add to the working expense and the operating grant may have to be increased suitably.

Out of the five new post-graduate courses proposed, it is doubtful whether the course for Steam Generation and Power should be started. There does not seem to be much demand for this course, even at the Indian Institute of Science, Bangalore. The other courses are important and may be accepted. The additional cost involved on account of these is not high.

In order to consolidate the existing undergraduate and post-graduate laboratories, certain deficiencies in equipment need correction and the request for the following items of additional equipment in the following sections is therefore supported:

(*a*) Applied Mechanics Section for the Machine Design.	Rs. 44,000	for post-graduate course
(*b*) Machines Laboratories		
for undergraduate	Rs. 20,000	
for post-graduate	Rs. 35,000	
TOTAL	Rs. 55,000	
(*c*) Heat Power Section		
For purchase of super-heater and other accessories for undergraduate work	Rs. 25,000	
I.C. Laboratories	Rs. 57,000	
(*d*) Foundry Laboratories		
Temperature Measuring equipment	Rs. 15,000	
Pattern Making Machines, etc.	Rs. 55,000	
(*e*) Industrial Laboratory	Rs. 36,000	

Department of Metallurgical Engineering

117. The Department of Mettalurgical Engineering was started in the year 1954 and the undergraduate course was started in the year 1954. The duration of the course is four years and the present annual intake capacity is 25. The total number of students in the undergraduate course is at present 91. Year-wise figures are also given below:—

1st year	24
2nd year	22
3rd year	26
4th year	19
TOTAL	91

The first batch of students graduated in the year 1958 and so far 10 students have passed the undergraduate course.

The Department conducts post-graduate courses in:

Advanced Ferrous Metallurgy was offered in 1958, but no suitable candidate was available.

The annual intake capacity for each of the post-graduate course and the number of students at present admitted to the course are shown against each course:—

Course	Capacity	Admitted
Advance Ferrous Metallurgy . . .	8	Nil

It also conducts research in the field of:—

(i) Extractive Metallurgy
(ii) Physical Metallurgy

At present there is one Research Scholar working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
Senior Professor	I	Nil
Professor	I	I
Assistant Professors	3	2
Lecturers	5	3
Assistant Lecturers	3	I
Senior Research Assistants . . .	2	I
Junior Technical Assistants . . .	2	2
Mechanics Grade ‘ A ’	2	I
Mechanic Grade ‘ B ’	I	I
Mechanics Grade ‘ C ’	2	2
Laboratory Attendants	5	4
Draughtsman	I	I
Clerk	I	I

The Department has at present 8,000 sq. ft. of accommodation of which 8,000 sq. ft. are used primarily for undergraduates and nil sq. ft. for post-graduate and/or research work.

The Department has also got equipment costing Rs. 3,52,200. The equipment costing Rs. 3,15,800 is used for the undergraduate course and the equipment costing Rs. 36,400 is used for post-graduate and/or research work.

Operating Cost: The Department gets an operating annual grant of Rs. 25,000.

Other Activities: In addition to the undergraduate and research work, the Department is doing consultative and research work for industry and other organisations, also conducting short-time courses for the graduate apprentices of Hindustan Steel Private Limited.

Proposals: The Department has now requested for additional accommodation of 16,000 sq. ft. 13,000 sq. ft. will be required for undergraduate work and 3,000 sq. ft. for post-graduate and/or research work.

The additional staff requested is:—

Assistant Professor	1
Lecturers	3
Senior Research Assistant	1
Junior Technical Assistant	1
Foreman	1

Committee's Observations

The activities of this Department have been largely devoted to the teaching in metallurgical subjects of undergraduate and post-graduate students of other departments.

A post-graduate course in Advanced Ferrous Metallurgy was offered during the present session, but no student was found suitable. No separate staff for post-graduate work has been sanctioned so far. The equipment which has been purchased does not appear to be adequate for conducting the undergraduate courses. Additional equipment costing about Rs. 78,000 will have to be purchased for undergraduate work only. This Department requires more space for classrooms, laboratories, etc. The present building is unsatisfactory as the laboratories are scattered and the rooms are small. There is no proper provision for X-Ray and photographic work. The teachers also do not have any rooms for themselves.

On account of the large demand for metallurgical engineers in the country at present, the Department has not been able to recruit suitable staff. Two Assistant Lecturer posts are vacant and there appears to be no possibility of filling them in the near future. The Department has suggested substitution of these by posts of Lecturer. The Department has made no recommendations for the creation of extra posts even for the post-graduate courses, but has suggested that the services of an Assistant Professor in Theoretical Physics may be made available either from the Physics Department or by the creation of an additional post. This point is covered by the Committee's recommendation to strengthen the Physics Department for teaching Solid State Physics.

The Department proposes to start post-graduate courses in (i) Light Alloys, (ii) Advanced Physical Metallurgy, and (iii) Continued Advanced Ferrous Metallurgy and to conduct research in problems of Extraction Metallurgy and Physical Metallurgy from 1959-60. The equipment requested for the purpose will cost about Rs. 41,000, the major part being Vacuum Melting and Extraction Unit costing Rs. 20,000. The Department proposes for starting two more post-graduate courses in the Third Five-Year Plan *viz.*, (i) Powder Metallurgy from 1961-62, (ii) Advanced Non-Ferrous Mettalurgy from 1962-63 and to reorganise the laboratories for research work. In the opinion of the Committee these developments will involve strengthening of the departmental staff at several levels.

The post-graduate work must not be allowed, however, to interfere the necessary upgrading of the undergraduate course in view of the importance of the subject to all branches of technology.

The Committee endorse the request for the purchase of equipment costing Rs. 78,000 for the undergraduate work and an additional sum of Rs. 1,63,000 for post-graduate studies. There is no justification for the purchase of an Electron Microscope, requested.

The Committee support the provision of a separate new building for the Department of Metallurgical Engineering of an area of about 16,000 sq. ft.

Department of Mining Engineering

118. The Department of Mining Engineering was started in the year 1956 with an undergraduate course. The duration of the course is four years and the present annual intake capacity is 25. The total number of students in the undergraduate course is at present 65. Year-wise figures are given below:—

1st year	23
2nd year	22
3rd year	20

The Department has not so far provided for any post-graduate courses.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
Teaching	6	4
Technical	4	4
Ministerial	1	1
Class IV	3	3

The Department has at present 6,359 sq. ft. of accommodation all of which is used for undergraduate teaching.

The Department has placed orders for equipment costing Rs. 96,000 wholly for the undergraduate course.

Operating Cost: The Department was given an operating grant of Rs. 3,000 in 1958-59.

Proposals: The Department has now been sanctioned new accommodation of 17,352 sq. ft. 13,184 sq. ft. will be required for undergraduate work and 4,168 sq. ft. for post-graduate and/or research work.

There is also a request for equipment costing Rs. 2,34,000. The equipment costing Rs. 2,04,000 will be required for undergraduate and equipment costing Rs. 30,000 for post-graduate and/or research work.

The additional staff requested is: Nil.

The post-graduate work proposed is expected to be conducted mainly at the mines.

Committee's Observations

The Committee recommend the acceptance of the request for additional equipment.

Department of Naval Architecture and Marine Engineering

119. The Department of Naval Architecture and Marine Engineering was started in the year 1952 and the undergraduate course was also started in the same year. The duration of the course is five years and the present annual intake capacity is 12. The total number of students in the undergraduate course, is at present 49. Year-wise figures are given below:—

1st year	13
2nd year	8
3rd year	8
4th year	11
5th year	9

The first batch of students graduated in the year 1957 and so far 22 students have passed the undergraduate course.

The Department conducts research and at present there are two Research Scholars in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
A. Academic		
Senior Professor	1	1
Professor	1	1
Assistant Professors	2	1
Lecturers	2	..
Assistant Lecturers	3	3
Senior Scientific Officer	1	1
Senior Research Assistant	1	1
TOTAL	11	8
B. Technical	8	6
C. Ministerial	1	1
D. Class IV	4	4

The Department has at present 15,020 sq. ft. of accommodation which includes a Ship Model Testing Tank and workshops measuring 8,310 sq. ft. in two sheds and the remaining area is in the old building and is used for class and staff rooms. All the accommodation is used both for the undergraduate course and research work.

The Department has equipment costing Rs. 3,61,000. This includes a Towering Carriage which has been ordered and is estimated to cost about Rs. 1·4 lakhs. All the equipment is used both for the undergraduate course and for research work.

Operating Cost: The Department at present gets an annual operating grant of Rs. 5,000.

Other Activities: In addition to the undergraduate course and research work, the Department is doing consultative and research work for industry and other organisations.

Proposals: The Department has made a request for an additional grant of Rs. 1,72,500. This includes installation charges of Rs. 30,000 for the Towering Carriage which has already been ordered and Rs. 80,000 for the extension of the Tank. It also includes Rs. 10,000 for a cavitation tank which is required for research work. The remaining amount is required for development of undergraduate courses.

Committee's Observations

The Committee are doubtful about the justification for the continued existence of this Department and in consequence for the Institute's remoteness from the sea and the forthcoming availability of the sister Institutes at Bombay and Madras. They recommend that a Special Committee be set up to consider these matters.

Department of Physics and Meteorology

120. The Department of Physics and Meteorology was started in the year 1951 to provide instruction to the undergraduates in the various technology departments. The duration of the course varies with the discipline concerned and the present instruction capacity is 400 which is about the number admitted annually to the various departments whose courses comprise instruction in Physics.

The Department conducts post-graduate courses in:—

(i) Industrial Physics
(ii) Metal Physics
(iii) Meteorology

The annual intake capacity for each of the post-graduate course and the number of students at present admitted to the course are shown against each course:—

	Intake capacity	Present strength	No. passed till 1958
Industrial Physics (1 year) .	4	2	2
Metal Physics (1 year) .	..	..	No student.
Meteorology (1 year) . .	4	2	1

It also conducts research in the field of Quantum Electro-dynamics, Metal Physics, Microwave Spectroscopy, Non-Linear Condenser, X-Ray Diffraction and Spectroscopy of Solids, Properties of Phosphorus and Semi-Conductors, Electronics, Properties of Solids and Transister Physics, Analytical Study of Storms and Thunderstorms, Collection of Ozore data.

Three teachers obtained doctorates and scholars are registered for Ph.D.

At present there are six Research Scholars working in the Department.

The position of sanctioned and existing staff is given below:—

	Sanctioned	Existing
Teaching . . .	15+2 S.R.A.	14 + 1 S.R.A.
Technical . . .	7 + 2 Junior Research Assistants	6 + 1 Junior Research Assistant
Ministerial . . .	1	1
Class IV . . .	7	7

The Department has at present 13,000 sq. ft. of accommodation of which 2,680 sq. ft. are used primarily for undergraduates and the balance for post-graduate and/or research work.

The Department has also got equipment costing Rs. 7,80,000. The equipment costing Rs. 78,900 is used for the undergraduate course and the balance is used for post-graduate and/or research work.

Operating Cost: The Department gets an operating annual grant of Rs. 35,000.

Other Activities: In addition to the undergraduate and research work, the Department is collaborating with the Indian Meteorological Department.

Proposals: The Department has now requested for additional accommodation of 4,000 sq. ft. 1,000 sq. ft. will be required for undergraduate work and 3,000 sq. ft. for post-graduate and/or research work.

There is also a request for equipment costing Rs. 1,06,500. The equipment costing Rs. 56,500 will be required for undergraduate and equipment costing Rs. 50,000 for post-graduate and/or research work.

The additional staff requested is:—

Teaching	6
Technical	6

Committee's Observations

The Committee recommend that the equipment required for undergraduate work be sanctioned. One of the main recommendations of the Committee is to the effect that the teaching of basic sciences to undergraduates needs further elaboration both in content and scope. The Committee are not in a position to assess reliably the extent to which the additional teaching load can be borne by the existing staff. This should be decided first before additional staff is considered for increased post-graduate and research work.

The Committee consider that the teaching of Solid State Physics and of its technological significance should form an integral part of the undergraduate instruction generally. If one of the existing Assistant Professors or Lecturers is not in a position to handle this subject, we recommend that an additional staff member should be provided. We have elsewhere referred to, and we take this opportunity of reiterating, the need for the undergraduate laboratory work in Physics to keep in step with the class room teaching. This would lessen the strain on the Lecturers and Laboratory Demonstrators and improve the effectiveness of the course.

Central Workshops

121. The Central Workshops comprise the following shops for instruction purposes:—

(i) Machine Shop
(ii) Tool Room
(iii) Pattern Shop
(iv) Smithy Shop
(v) Carpentry Shop
(vi) Fitting Shop
(vii) Foundry Shop
(viii) Welding Shop
(ix) Automobile, Painting and Electrification Shop

It also undertakes work for departments within the following additional shops:—

(1) Electrical Maintenance Shop
(2) Mechanical Maintenance Shop
(3) Precision Shop
(4) Blue Printing and Rota Printing Section
(5) Photographic Section
(6) Power House Section

It is, therefore, a Service Department to the Institute in the matter of repairs of all equipment other than precision and electronic equipment. The number of work orders received from the various departments is nearly 1,300 per year. On account of shortage of staff, and the miscellaneous nature of the work, casual labour has to be engaged.

Most of the equipment was purchased some years ago and, due to the fact that demands for maintenance and repairs has increased enormously, the facilities are not now adequate.

The present area of the Workshops is 57,013 sq. ft. all in sheds. It also has a Foundry Training Centre of 10,507 sq. ft. The Committee recommend that a further area of 9,600 sq. ft. be provided as per details given below:—

(*i*)	Electrical Maintenance Shop . .	1,500 sq. ft.
(*ii*)	Mechanical Maintenance Shop . .	1,750 sq. ft.
(*iii*)	Sub-Store	1,500 sq. ft.
(*iv*)	Extension of Garage	1,000 sq. ft.
(*v*)	Timber Godown	1,000 sq. ft.
(*vi*)	Superintendent of Workshop Office .	600 sq. ft.
(*vii*)	Blacksmithy Shop	750 sq. ft.
(*viii*)	Extension of existing shops for Five-Year Integrated Course	2,500 sq. ft.
	Total	9,600 sq. ft.

The Committee further recommend that the following equipment be purchased for the Electrical Maintenance Shop:

(1) Armature Coil Winding Lathe with Turn Counter Attachment.

(2) Coil Winding Lathe Small table Mounting type.

(3) Conduit Pipe Bending Vice ranges ½", ¾", 1", 1¼", 1½" and 2" maximum.

(4) 5 K.G. Berranger type double pan with weight box (minimum weight 1 gm.).

(5) Avometer.

(6) Bench Drilling Machine.

(7) Testing Switch Board Panel.

(8) Megger (G.E.C.).

Rs. 15,500

The purchase of the following additional equipment for Mechanical Maintenance is also recommended:

Equipment and accessories	Rs. 15,000

(a) Lathe
(b) Grinder
(c) Drilling Machine
(d) Fitters Bench
(e) Lifting Tackle
(f) Pipe fitting accessories

A large quantity of Institute and Hall furniture requires periodic repair and involves considerable accounting recruited for this work:—

One Supervisor.
One Lower Division Clerk
One Painter and two Shop Attendants

The Foundry Training Centre is under the joint control of Professor of Mechanical Engineering and the Superintendent of Workshops. There is a proposal for setting up instruction classes for Foundry Foremen and Short-term Specialised Foundry Training course. This work should be undertaken by the existing staff on a part-time basis.

Photographic and Blue Printing Section

It is proposed to start colour photography and the cost of the equipment required is Rs. 25,000. The Committee do not approve this proposal.

Sub-Store: A Sub-store for the workshops has been requested and is recommended for proper control of the consumption of the materials drawn from the Central Stores. The requirements are given below:—

Staff

(1) Store-keeper	1
(2) Store Attendant Group I	1

Blacksmithy Shop: The present arrangement of this section is not satisfactory. Exhaust Fans, cowling and ducting at a cost of Rs. 5,000 *plus* other tools costing Rs. 5,000 should be sanctioned.

There is no Assistant Superintendent of Workshops at present The Committee recommend that this post be created.

Central Instruments Services Section

122. The Institute has submitted proposals for the establishment of a Central Instruments Services Section to perform the following functions:

(i) Repair, design, development and construction of (a) electronic, (b) optical, photographic and survey and (c) precision mechanical instruments

(ii) Maintenance and installation of (a) internal telephones, (b) audio-visual equipment

(iii) Repair of Electrical Meters

(iv) Battery repairs and maintenance including supply of steady d.o. power.

(v) Operation, maintenance and repair of specialised equipment such as—

- (a) Mass Spectrograph
- (b) Electron Microscope
- (c) X-Ray equipment
- (d) IBM Machine
- (e) Electronic Computor

(vi) Training of Laboratory Technicians

The Committee support the proposal but doubt the need for early acquisition of a Mass Spectrograph and an Electron Microscope. It is suggested that the Section be built up gradually over the next few years under the supervision of an appropriately constituted inter-departmental committee with the staff of the Electronics and Communications Department carrying a special responsibility.

The Committee worked out, with the staff members concerned, the approximate requirements in space, staff and equipment for this Section and details of these are given below:—

A. Space required would be roughly as follows :

Working space for equipment and operators	3,000 sq. ft.
Battery charging (separate unit with exhaust fan)	500 ,,
Electronics repair and fabrication	750 ,,
X-Ray outfit	400 ,,
IBM Machine	400 ,,
Electronic Computer (one or two rooms to be air-conditioned)	750 ,,
Telephone repair	150 ,,
Draftsman's room	100 ,,
Conference room	300 ,,
Stores	750 ,,
TOTAL	7,200 sq. ft.

B. The staff required for the Section would be as follows :—

X-Ray outfit	One J.S.O.	
I.B.M. Machine	Supervisor. J.S.O.	One
	Card designer (J.S.O.)	One
	Maintenance (TA-1)	One
	Operator (U.D.C.)	One
	Puncher (L.D.C.)	One
Electronic Computer	One S.S.O.+two T.A. (I) +two Mechanic Gr. " A "	
Electronic repair	One S.S.O. + two T.A. (I)	
Instrument fabrication	One S.S.O. + two T.A. (I)+ three T.A. (II) + five Mechanics Gr. 'A' + six Mechanics Gr. 'B'	
Draftsman	One	
Paid Apprentice trainees	Six	
Laboratory Attendants	Five	
Store-keeper-*cum*-clerk	One	
Battery charging	One Mechanic—Gr. 'A'	
Telephones	Staff available	
Electric meters	One T.A. (I)	

C. List of equipment for the proposed Central Instruments Service Section :—

	Rs.
(1) High Precision Lathes	50,000
(2) Jewellers' and Watch Makers' Bench Lathe	4,500
(3) High speed precision drilling machine (vertical)	8,000
(4) Universal Grinding Machine (internal and external)	30,000
(5) Metal Automatic Sawing Machine	4,500
(6) Shaping Machine 12" stroke	2,500
(7) Surface Grinding Machine horizontal with magnetic check	5,000

	Rs.
(8) Three-dimensional Patograph Machine .	25,000
(9) Furnace and accessories (to be locally fabricated)	5,000
(10) Spot Welding Machine	8,000
(11) Meter-Coil Winding attachment (Main coil winder available)	1,500
(12) Vacuum impregnation outfit including pump	4,000
(13) Dielectric and Induction Heaters (to be locally made)	5,000
(14) Vacuum casting accessories with pump (to be locally made)	1,500
(15) Rolling Machine (small)	1,000
(16) Wire Drawing Machine	500
(17) Electroplating, Polishing and Spraying outfit (to be locally made)	3,000
(18) Glass cutting tools and accessories .	500
(19) Engraving Machine (already in the Chemistry Department)	10,000
(20) Electric Polishing Machine (small) .	1,000
(21) do. all machine (small) .	5,000
(22) Miscellaneous electronic and electrical measuring instrument (in addition to what are already available) . . .	10,000
(23) Miscellaneous tools and accessories .	10,000
	195,500
(24) Equipment etc., for Battery charging	
Two chargers (large)—110 V, 15A .	4,000
Three ,, ,, ,, 30 V, 10A .	2,000
Control panel (to be locally made) .	200
Jars, Hydrometers, etc.	500
Plates, separators and other materials for repair and servicing	1,300
	8,000
(25) X-Ray equipment (available). Two cameras to be purchased	25,000
(26) IBM Machine (available)	
(27) Electronic Computer—Analogue type available.	
(28) Miscellaneous specialised stores, materials and accessories (mechanical, electrical, electronic)	50,000

Library

123. The Library of the Institute was established in 1950 with a collection of 2,500 books. A grant of Rs. 38,769 for books and Rs. 4,250 for journals was made in 1951. This would appear to be a meagre sum to begin with, considering that books on science and technology are generally costly, and new purchases have to be constantly made if an institution offering over a dozen technological subjects is to keep abreast of the latest developments. The total stock in the Library at the moment is over 39,000. The journals to which the Library subscribes and which it receives as gift or exchange together total 625, and steps are being taken to procure all the back numbers of the more important journals. Each of the Institute's Department has its separate allocation for books, and amounts can be transferred from the budget of one Department to another with the consent of the Director.

At the moment, the Library Hall is used as a Reading Room, with shelves for journals on one side. Books are stacked on two mezzanine floors, about 20′ wide, that run along the length of the Hall on the same side.

The Library is under the supervision of a Library Committee, set up under an Ordinance. Since May, 1957, Professor S. Gupta has been the Chairman. The members of the Committee are the following:—

(*i*) Prof. S. B. Sen
(*ii*) Prof. V. N. Prasad
(*iii*) Prof. S. K. Bhattacharya
(*iv*) Prof. B. R. Seth
(*v*) The Librarian

The present Library Rules were framed in 1954. The Library is open from 8·00 A.M. to 10·00 P.M. on all week days. On Saturdays, the Library is kept open from 8·00 A.M. to 4·00 P.M. and on Sundays from 8·00 A.M. to 12·00 noon. It follows an open access system, which is reported to have been an inducement to wider reading. A system of inter-Library co-operation, specially with Libraries in Calcutta has been introduced and books and journals not available in the Library are procured when necessary. A stock of 1,150 microfilms of original papers has been collected to meet the requirements of research workers. Academic staff can have up to 10 and students and other categories of staff two books issued to them at a time. The number of books and journals issued daily is about 140. Departments have 100 books issued to them and these constitute the Department Library.

The staff of the Library consists of the Librarian, three Assistant Librarians, four Upper Division Clerks and five Lower Division Clerks, nine Grade I and six Grade II Attendants, and three Grade B Mechanics.

In his note the Librarian has pointed out the inadequacy of office space and the difficulties experienced in the use of the Library frequently by the holding of functions and examinations in the Hall. He has also asked for more staff in order to maintain the Library properly to keep up-to-date in binding and to increase the efficiency of the service.

A summary of the additional requirements of the Library is given below: —

Recurring	
Staff	
Deputy Librarian—1 (Scale Rs. 350—350—380——380—30—590—EB—30—770—40—850)	Rs. 7,200 per year
Assistant Librarian—2 (Rs. 260—10—300—15—450—25/2—500)	Rs. 9,120 ,,
Mechanic (book-binder) Grade B-2 (Rs. 80—3—120)	Rs. 2,400 ,,
Attendant, Grade I—4 (Rs. 40—1—50—2—60)	Rs. 2,400 ,,
Liftman (Rs. 80—5—120)	Rs. 1,200 ,,
Upgrading post of the Librarian (Rs. 600—40—1000 (plus D.A. Rs. 100) to Rs. 600—40—1000—50/2—1150)	Rs. 900 ,,
Books*	Rs. 5,000 ,,
Current Journals	Rs. 20,000 ,,
Microfilms and Photoprints	Rs. 2,000 ,,
TOTAL	Rs. 50,220 ,,
Non-recurring	
Space—5,000 sq. ft..	Rs. 180,000
Lift	Rs. 50,000
Back volumes of periodicals	Rs. 300,000
TOTAL	Rs. 530,000

---

*This includes additional expenditure on staff which comes under Establishment Charges

Committee's Observations

The Institute will one day need a building or part of a building constructed specifically to meet the requirements of an efficient modern Library. But for some time the existing accommodation would suffice if dwarf shelves were put between the existing shelves and between the pillars. The Hall, however, is unsuitable as a Reading Room, and there is no provision of cubicles for study. Six of these could be easily built at small cost along the side of the Hall where the journals are not kept. A lift would no doubt be a convenience, but is not a necessity.

Some addition to the lower grade staff may be made, but the question how far the Library service could be improved and extended through division of work among the teaching staff should be thoroughly investigated before the appointments of a Deputy and an Assistant Librarian are sanctioned. The pressure on the Library staff could perhaps also be relieved if the departmental libraries were allowed to keep more books needed mainly or exclusively by them.

The additional amounts asked for books, current journals, microfilms and photo prints and back volumes of periodicals may be sanctioned.

APPENDIX I

Programme of the Reviewing Committee at Indian Institute of Technology, Kharagpur

Sunday, the 1th January, 1959	Visit of the Chairman to Dr. B. C. Roy, Chairman, Board of Governors of the Institute in Calcutta.
Monday, the 12th January, 1959	Meeting and discussions amongst the members of the Committee. Meeting with the Director. Meeting with the Academic Council.
Tuesday, the 13th January, 1959	(*i*) Visit to the Departments of Mechanical Engineering, Workshops, Naval Architecture and Marine Engineering. (*ii*) Visit to the Departments of Chemical Engineering and Metallurgy. Visit to the Technology Hospital and interview with the Medical Officer.
Wednesday, the 14th January, 1959	Visit to the Departments of Architecture and Regional Planning, Civil Engineering and Geology and Geophysics. Visit to the Departments of Agricultural Engineering and Mining Engineering. Prof. M. Mujeeb visited the Department of Humanities and Social Sciences.
Thursday, the 15th January, 1959	Visit to the Departments of Applied Chemistry, Physics and Meteorology, and Electronics and Electrical Communication Engineering. Visits to Library and the Department of Electrical Engineering, Humanities and Social Sciences and Mathematics.
Friday, the 16th January, 1959	Interviews with Group of Professors representing Science, Engineering, Geology, Architecture and Humanities (Six). Interviews with Administrative Staff (Five). Interviews with Groups of Technical Staff (Six). Interviews with Representatives of Academic Staff other than Professors (Ten)
Saturday, the 17th January, 1959	Interviews with Vice-President and Office Bearers of the Students' Gymkhana (Seven). Interviews with Students' Representatives of the Halls of Residence (Seven).

	Interviews with Group of Ministerial Staff (Four).
	Interviews with Group of Class IV Staff (Eight).
	Interview with the Secretary, Alumni Association.
	Interview with the President of the Students' Gymkhana.
	Interviews with the Wardens, Halls of Residence.
Monday, the 19th January, 1959 . .	Meeting with the Director.
	Meeting of the Reviewing Committee with Dr. B. C. Roy.

On the Committee's return to Delhi the Chairman had discussions with the following members of the Board of Governors :—

Professor M. S. Thacker, Secretary of the Ministry of Scientific Research and Cultural Affairs and Director General, Council of Scientific and Industrial Research

Dr. C. D. Deshmukh, Chairman, University Grants Commission.

Shri G. K. Chandiramani, Joint Educational Adviser, Ministry of Scientific Research and Cultural Affairs

APPENDIX II

Papers Received by the Reviewing Committee

The Institute authorities supplied the following papers :—

Institute Prospectus 1958-59

Information Brochure for Post-Graduate Courses 1958-59

Annual Reports 1953-54, 1954-55, 1955-56, 1956-57 and 1957-58.
Convocation Brochure 1958
Old Regulations (Bulletin)

Director's Second Memorandum

Sarkar Committee Report

Act and Statutes

Ordinance

Notes prepared by the Director :

(*a*) All India Character of the Institute
(*b*) Admission to under graduate courses
(*c*) Award of scholarships to undergraduate students
(*d*) Housing for the student
(*e*) Student amenities
(*f*) Practical training facilities and employment bureau
(*g*) Introduction of Five-Year Integrated Courses
(*h*) Hospital
(*i*) Dairy
(*j*) Drainage
(*k*) Boundary wall
(*l*) Accommodation for the National Cadet Corps
(*m*) Security
(*n*) Staff housing
(*o*) Staff amenities
(*p*) Institute Act— a section of staff aggrieved
(*q*) Estimates Committee Report
(*r*) Audit Report
(*s*) Relationship between the Central Government and the Institute
(*t*) Suitable arrangement for payment of grant-in-aid
(*u*) Purchase procedure and difficulties

The Director also made available to the Committee a number of other papers and files

Reports and memoranda prepared by the Departments and by other functional units of the Institute :—

(*i*) Agricultural Engineering
(*ii*) Architecture and Regional Planning

(*iii*) Applied Chemistry

(*iv*) Chemical Engineering

(*v*) Civil Engineering

(*vi*) Electrical Engineering

(*vii*) Electronics and Electrical Communication Engineering

(*viii*) Geology & Geophysics

(*ix*) Humanities and Social Sciences

(*x*) Mathematics

(*xi*) Mechanical Engineering

(*xii*) Metallurgical Engineering

(*xiii*) Mining Engineering

(*xiv*) Naval Architecture and Marine Engineering

(*xv*) Physics and Meteorology

(*xvi*) Security

(*xvii*) Central Workshops

(*xviii*) Central Services Section

(*xix*) Library

(*xx*) Training and Placement

(*xxi*) Engineering Unit

(*xxii*) Lands and Garden Committee

(*xxiii*) Halls of Residence

(*xxiv*) Gymkhana

(*xxv*) Staff Club

(*xxvi*) Technology Club

(*xxvii*) Journal of Science and Engineering Research

(*xxviii*) Hijli High School

(*xxix*) Teachers Forum

(*xxx*) Medical Unit

(*xxxi*) Administrative Office

(*xxxii*) Joint Memorandum from Dr. Gayon and Mr. Chowdhury of Statistical Unit

(*xxxiii*) Scheme for Refuse Collection and Disposals with comments from Deputy Director

(*xxxiv*) Brief notes from various groups of staff and students for discussions with the Committee

APPENDIX III

Constitution and Composition of the Board of Governors

Constitution	Composition
(A) The Chairman to be nominated by the Visitor of the Institute.	(A) Dr. B. C. Roy, Chief Minister, West Bengal, Writers' Buildings, Calcutta.
(B) One non-official to be nominated by the Central Government.	(B) Fl. Lt. His Highness Pratap Chander Bhanju Deo GCIE, KCIE, Maharaja of Mayurbhanj, 7, Mayurbhanj Road, Calcutta-23.
(C) One person to be nominated by the All India Council for Technical Education.	(C) Sir Jehangir J. Ghandy, Tata Iron and Steel Co. Ltd., Jamshedpur.
(D) The Director of Scientific and Industrial Research, Government of India (*ex-officio*).	(D) Prof. M. S. Thacker, Secretary, Ministry of Scientific Research and Cultural Affairs, Government of India, New Delhi.
(E) Chairman, University Grants Commission—*ex-officio.*	(E) Dr. C. D. Deshmukh, Old Mill Road, New Delhi.
(F) The Director—*ex-officio.* . . .	(F) Dr. S. R. Sen Gupta, Indian Institute of Technology, Kharagpur.
(G) Three persons nominated by the Central Government, one to represent the Ministry of Education (now Ministry of Scientific Research and Cultural Affairs), another the Ministry of Finance and the third the other Ministries.	(G) Shri G. K. Chandiramani, Joint Educational Adviser (T), Ministry of Scientific Research and Cultural Affairs, Government of India, New Delhi. Shri A. V. Venkateswaran, Financial Adviser (Education Division), Ministry of Finance, Government of India, New Delhi. Shri S. S. Khera, Secretary, Department of Mines and Fuel, Ministry of Steel, Mines and Fuel, Government of India, New Delhi.
(H) Three members of Parliament—two to be elected from among themselves by the members of the House of People and one from among themselves by the members of the Council of States.	(H) Shri S. N. Das, Member, Lok Sabha, Maha Seth Colony, Darbhanga, Bihar. Shri J. N. Lahiri, Member, Lok Sabha, Serampur, West Bengal. Shri Amar Nath Agarwal, Member, Rajya Sabha, Bari Kothi, Allahabad, Uttar Pradesh.

APPENDIX IV

Constitution of the Academic Council

(*a*) Chairman—The Director (*ex-officio*).

(*b*) Vice-Chairman—The Deputy Director (*ex-officio*).

(*c*) The Registrar (*ex-officio*).

(*d*) The Professors appointed or recognised as such by the Institute for the purpose of imparting instruction in the Institute (at present 20 in number)

(*e*) Such other members of the staff as may be laid down in the Statement, in addition to the persons referred to at (*a*), (*b*), (*c*) and (*d*) above, the Statutes provide for the following to be members of the Academic Council :

- (*i*) Heads of the Departments, other than Professors (at present four in number)
- (*ii*) The Librarian of the Institute
- (*iii*) One Warden by rotation in order of seniority in service as Warden, for a period of one year
- (*iv*) Workshop Superintendent
- (*v*) Not more than six other members of the staff for their special knowledge appointed by the Chairman after consultation with the Director for such period as may be specified by the Chairman.

APPENDIX V

TABLE I

Undergraduate Courses

Departments	Date of starting the Department	Date of commencement of undergraduate courses	Duration	Designation of award	Sanctioned intake of undergraduate students
Civil Engineering	1951	August, 51	4 years	B. Tech.	100
Electrical Engineering (Power)	1951	August, 51	4 years	B. Tech. As elective in the final year of Electrical Engineering.	75
Electronics and Electrical Communication Engineering	1951	July, 55			
Mechanical Engineering	1951	August, 51	4 years	B. Tech.	75
Agricultural Engineering	1952	July, 52	4 years	B. Tech.	30
Metallurgical Engineering	1954	July, 55	4 years*	B. Tech.	25
Chemical Engineering	1951	July, 56	4 years	B. Tech.	15
Mining Engineering	1956	July, 56	4 years	B. Tech.	25
Naval Architecture and Marine Engineering	1952	July, 52	5 years	B. Tech.	12
Architecture and Regional Planning	1952	July, 52	5 years	B. Arch.	30
Geology and Geophysics	1951	July, 52	3 years	B. Sc.	20
Mathematics	1951	..	..	..	..
Physics and Meteorology	1951	..	..	..	..
Chemistry	1951	..	..	..	..
Humanities and Social Sciences	1951	..	..	..	..
					407

---

*A batch of students admitted in 1954 to other departments entered the 2nd year of the Metallurgical Engineering course in 1955. The initial entry of 1st year students was made in 1955.

APPENDIX V

TABLE II

Post-Graduate Courses

Sl. No.	Year of starting of Department	Year of starting of course	Duration of the course	Annual intake capacity	Present strength	No. passed out so far
	1	2	3	4	5	6
I. Department of Agricultural Engineering	1952					
(1) (*i*) Applied Botany		1956	1 year	4	1	2
(2) (*ii*) Farm Power & Machinery . .		1956	1 year	4	2	3
(3) (*iii*) Soil & Water Conservation Engineering . . .		1958	1 year	4	4	. .
II. Department of Applied Chemistry	1951					
(4) (*i*) Technical Gas Reaction and High Pressure Technology . . .		1953	1 year	8	3	12
(5) (*ii*) High Polymer and Rubber Technology . . .		1958	1 year	8	2	. .
(6) (*iii*) Synthetic Drugs and Fine Chemicals		1958	1 year	8	2	. .
III. Department of Architecture and Regional Planning	1952					
(7) (*i*) Regional Planning (Degree) . .		1955	2 years	4	1+3 (2nd yr.)	5
(8) (*ii*) Regional Planning (Diploma) .		1956	2 years	4	3+2 (2nd yr.)	3
IV. Department of Chemical Engineering	1952					
(9) (*i*) Combustion Engineering and Fuel Economy . . .		1952	1 year	8	10	31

(10) (*ii*) Chemical Plant Design and Fabrication		1957	1 year	8	10	8
V. Department of Civil Engineering						
(11) (*i*) Harbour Engineering	1951		1 year	8	..	..
(12) (*ii*) Highway Engineering		1955	1 year	6	3	6
(13) (*iii*) Municipal Engineering		1958	1 year	8	2	..
(14) (*iv*) Soil Mechanics & Foundation Engineering		1955	1 year	6	6	3
(15) (*v*) Structural Engineering		1955	1 year	8	7	22
(16) (*vi*) Dam Construction and Water Power Engineering		1955	1 year	8	6	17
VI. Department of Electrical Engineering	1951					
(17) (*i*) Electrical Machine Design		1955	1 year	8	6	19
(18) (*ii*) Control System Engineering		1958	1 year	8	2	..
VII. Department of Electronics and Electrical Communication Engineering	1951					
(19) (*i*) Industrial Electronics		1958	1 year	4	2	..
(20) (*ii*) Radio Broadcast Engineering		1955	1 year	4	3	11
(21) (*iii*) Ultra High Frequency and Micro-wave Engineering		1957	1 year	4	2	3
VIII. Department of Geology and Geophysics	1952					
(22) (*i*) Applied Geology		1955	2 years	4	2+2(2nd yr.)	8
(23) (*ii*) Exploration Geophysics		1955	2 years	4	4+3 (2nd yr.)	5
(24) (*iii*) Geochemistry		1958	1 year	4	1	..
IX. Department of Mathematics	1951					
(25) (*i*) Non-Linear Mechanics		1957	1 year	6	3	2

	1	2	3	4	5	6
X. Department of Mechanical Engineering	1951					
(26) (*i*) Foundry Engineering		1958	1 year	20	6	..
(27) (*ii*) Industrial Engineering		1953	1 year	8	9	17
(28) (*iii*) Machine Design		1956	1 year	4	1	7
(29) (*iv*) Mechanical Handling		1954	1 year	8	3	8
(30) (*v*) Production Technology		1952	1 year	8	9	40
(31) (*vi*) Refrigeration and Air-Conditioning Plant		1957	1 year	4	2	1
(32) (*vii*) Turbo-Machinery/Design of Internal Combustion Engine		1956	1 year	4	2	2
(33)(*viii*) Mechanisms and Vibration		1955	1 year	4	..	4
XI. Department of Metallurgical Engineering	1954					
(34) (*i*) Ferrous Metallurgy			1 year	8	..	..
XII. Department of Physics and Meteorology	1951					
(35) (*i*) Industrial Physics		1955	1 year	4	2	2
(36) (*ii*) Meteorology		1956	1 year	4	2	1
XIII. Department of Humanities and Social Sciences						
(37) (*i*) Industrial Psychology and Industrial Relations. (Diploma)		1958	1 year	4	2	..

APPENDIX V

TABLE III

Growth of student population in the beginning of the session

	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59
Undergraduate								
1st Year	210	286	298	301	321	380	392	449
2nd Year	..	193	270	291	288	309	367	338
3rd Year	..	..	190	268	277	286	304	365
4th Year	..	..	..	180	249	254	274	295
5th Year	..	..	..	..	..	20	28	31
TOTAL	210	479	758	1,040	1,135	1,249	1,365	1,478
Post-Graduate	..	18	47	31	93	87	101	152
Research Scholars	..	15	22	30	48	43	49	49
Post-Doctoral Fellow	..	..	..	..	2	3	2	2
GRAND TOTAL	210	512	827	1,101	1,278	1,382	1,517	1,681

APPENDIX V

TABLE IV

Growth of student population as at the end of the session

	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	In January, 1959 1958-59
Undergraduate Courses								
1st Year	193	270	291	284	306	366	336	421
2nd Year	..	190	268	288	287	302	366	334
3rd Year	..	..	180	263	277	284	302	364
4th Year	..	..	..	172	243	254	274	296
5th Year	..	..	..	..	..	20	28	31
TOTAL	193	460	739	1,007	1,118	1,226	1,306	1,446
Post-Graduate Courses	..	16	26	5	83	82	85	132
Strength of Research Scholars	..	15	22	30	48	43	49	42
Strength of Post-Doctoral Fellows	..	..	..	..	2	3	2	1
GRAND TOTAL	193	491	787	1,042	1,251	1,354	1,442	1,621

APPENDIX V

TABLE V

Undergraduate Courses Session (1958-59)

Sl. No.	Course of study	Intake Capacity	Present strength					
			1st year	2nd year	3rd year	4th year	5th year	Total
1.	Agricultural Engineering	30	19	9	21	17	..	66
2.	Architecture	30	24	12	20	13	22	91
3.	Chemical Engineering	15	16	13	13	..	..	42
4.	Civil Engineering	100	107	93	102	96	..	398
5.	Electrical Engineering	75	90	70	63	63+5(EEC)	..	291
6.	Geology & Geophysics	20	15	13	17	..	..	45
7.	Mechanical Engineering	75	89	72	74	72	..	307
8.	Metallurgical Engineering	25	25	22	26	19	..	92
9.	Mining Engineering	25	23	22	20	..	..	65
10.	Naval Architecture and Marine Engineering	12	13	8	8	11	9	49
	TOTAL	407	421	334	364	296	31	1,446

APPENDIX V

TABLE VI

Undergraduate Courses

Number of Students passed out in Final Bachelor's Degree Examination from I.I.T.

Courses of Study	1955			1956			1957			1958			Total No. of students passed out from 55-58		
	1st Class	2nd Class	Total	1st Class	2nd Class	Total	1st Class	2nd Class	Total	1st Class	2nd Class	Total	Total passed	1st Class	2nd Class
B. Tech.															
1. Civil Engineering	35	38	73	45	37	82	55	35	90	85	15	100	345	220	125
2. Electrical Engineering (Power)	28	14	42	33	19	52	29	17	46	40	10	50	190	130	60
Do. (Communication)	..	..	..	6	6	12	4	1	5	4	..	4	21	14	7
3. Mechanical Engineering	46	8	54	50	9	59	49	5	54	58	7	65	232	203	29
4. Metallurgical Engineering	..	..	..	..	..	..	..	..	..	6	4	10	10	6	4
5. Agricultural Engineering	..	..	..	11	5	16	12	17	29	9	4	13	58	32	26
6. Chemical Engineering	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7. Mining Engineering	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8. Naval Architecture	..	..	..	..	..	..	7	4	11	8	3	11	22	15	7
B. Arch.															
9. Architecture	..	..	..	..	..	..	2	7	9	11	6	17	26	13	13
B. Sc.															
10. Geology and Geophysics	8	5	13	10	3	13	7	2	9	3	2	5	40	28	12
TOTAL	117	65	182	155	79	234	165	88	253	224	51	275	944	661	283

APPENDIX V

TABLE VII

Number of Students passed out in Final M. Tech. Degree/Diploma Examination

Sl. No.	Department	Courses of Study	1954	1955	1956	1957	1958	Total
1.	Agricultural Engineering	Applied Botany	..	..	..	1	1	2
		Farm Power & Machinery.	..	..	..	..	3	3
2.	Applied Chemistry.	Technical Gas Reaction and High Pressure Technology	..	2	3	2	5	12
3.	Architecture and Regional Planning	Regional Planning (Degree)	..	..	..	4	1	5
		Regional Planning (Diploma)	..	..	..	3	..	3
4.	Chemical Engineering	Combustion Engineering and Fuel Economy	9	7	3	4	8	31
		Chemical Plant Design and Fabrication	..	..	..	..	8	8
5.	Civil Engineering	Dam Construction and Water Power Engg.	..	..	7	5	5	17
		Structural Engineering and Transport Engg.	..	..	6	12	4	22
		Highway Engineering	..	..	4	2	..	6
		Soil Mechanics and Foundation Engg.	..	..	3	..	..	3
6.	Electrical Engineering	Electrical Machine Design/Design of Electrical Machinery	..	..	7	5	7	19
7.	Electronics and Electrical Communication Engineering	Ultra High Frequency & Microwave Engineering	..	..	..	..	3	3
		Advanced Broadcast Engineering	..	..	3	4	4	11
8.	Mathematics	Non-Linear Mathematics	..	..	..	..	2	2
9.	Geology & Geophysics.	Applied Geology	..	..	..	4	4	8
		Exploration Geophysics	..	..	..	3	2	5
10.	Mechanical Engineering	Mechanical Engineering Handling	..	4	4	..	..	8
		Production Technology	7	10	8	5	10	40
		Industrial Engg. and Management	..	7	..	5	5	17
		Mechanism & Vibration	..	..	4	..	..	4
		Design of Turbo-Machines	..	..	..	2	..	2
		Machine Design	..	..	..	2	5	7
		Refrigeration and Air-Conditioning Plant Design	..	..	..	..	1	1
11.	Physics and Meteorology	Industrial Physics	..	..	1	1	..	2
		Meteorology	..	..	..	..	1	1
		TOTAL	16	30	53	64	79	242

APPENDIX V

TABLE VIII

Research Scholars as on 6th January, 1959

S. No.	Department	Number sanctioned	Existing strength	Post-Doctoral Fellow	
				Existing	Sanctioned
1.	Agricultural Engineering	5	3	..	5
2.	Architecture and Regional Planning	*1 + 1	..	..	(for any Department)
3.	Applied Chemistry	10	7	..	
4.	Chemical Engineering	8	8	..	
5.	Civil Engineering	..	..	..	
6.	Electronics and Electrical Communication Engineering	3	2	..	
7.	Electrical Engineering	2	..	..	
8.	Geology and Geophysics	5	3	..	
9.	Humanities and Social Sciences	1+2	3	..	
10.	Mathematics	9	8	1	
11.	Mechanical Engineering	*1+1	..	..	
12.	Metallurgy	1	1	..	
13.	Physics and Meteorology	8	6	..	
14.	Naval Architecture and Marine Engineering	1	1	..	
15.	Mining Engineering	..	..	..	
	TOTAL	55	42	1	5

*Temporarily transferred to the Department of Humanities

APPENDIX V

TABLE IX

Ph.D. Degree Awards

Department/Subject	Year of Award		
	1957	1958	1959-Jan.
Applied Chemistry	5	1	1
Chemical Engineering	2	..	..
Mathematics	1	6	..
Physics	..	1	1
Applied Botany	..	1	..
TOTAL	8	9	2

APPENDIX V

TABLE X

Academic Staff

Designation	Number of sanctioned posts	Number in position as on 15-1-1959
Director	1	1
Deputy Director	1	..
Librarian	1	
Senior Scientific Officer	1	1
Senior Professor	13	4
Professor	19	13
Assistant Professor	54	53
Lecturer	101	78
Assistant Lecturer/Instructor	113	80
Farm Superintendent	1	1
Workshop Superintendent	1	1
Senior Research Assistant	32	22
Junior Research Assistant	18	9
TOTAL	356	264

APPENDIX V

TABLE XI

Capital Works

S. No.	Actual expenditure up to 1957-58 and expenditure likely to be incurred in 1958-59	Amount sanctioned for 1959-61	Total	Additional requirement not yet sanctioned
	(In lakhs)	(In lakhs)	(In lakhs)	(In lakhs)
1. Educational Buildings	Rs. 103·46	Rs. 17·00+ Rs. 2·00 (liability)	Rs. 122·46	Rs. 8·00
2. Staff Quarters .	Rs. 69·08	Rs. 17·63	Rs. 86·71	Rs. 33·92
3. Students' Halls .	Rs. 67·05	Rs. 1·00	Rs. 68·05	Rs. 13·00
4. Services & Amenities	Rs. 36·54	Rs. 24·32	Rs. 60·86	Rs. 28·43
5. Minor Works .	Rs. 10·00	Rs. 2·00	Rs. 12·00	..
6. Departmental Charges	Rs. 22·36	(included in the above figures).	Rs. 22·36	..
TOTAL .	Rs. 308·49	Rs. 63·95	Rs. 372·44	Rs. 83·35

APPENDIX V

TABLE XII

Educational Buildings

Buildings	Already constructed		Cost (Rupees in lakhs)	Under construction to be completed within 2nd Plan period		Cost (Rupees in lakhs)	Proposed for construction	Cost (Rupees in lakhs)	Remarks
	Net available area	Plinth area approx.		Net area	Plinth area				
	sq. ft.	sq. ft.		sq. ft.	sq. ft.		sq. ft.		
1. Main Building	1,79,067	3,03,854	86·24	..	..	2·00	..	..	
2. Extension to Main Building	14,630	20,000	3·72	10,000	13,000	4·00	..	..	
3. Agricultural Engineering									
(a) Main Block	13,744	22,000	5·69	..	..	..	..	..	
(b) Sheds	11,815	15,000							
4. Foundry	12,436	17,000	4·00	..	..	..	..	..	
5. Mechanical Engineering Building	..	..	..	24,000	32,750	9·00	..	4·00	(at present in old building)
6. Mining Engineering Building									
(a) Main Block	..	..	..	9,156	12,042	4·00	..	..	(at present has 5,000 sq. ft. in Agricultural Engg. Building).
(b) Sheds	..	..	..	4,200	5,000				
7. Sheds									
(a) Permanent sheds including Naval Architecture Tank.	20,366	22,000	3·81	..	..	..	..	..	
(b) Temporary Sheds	65,508	70,000							
8. Metallurgy	..	..	..	..	..	..	..	..	
9. Minor Works (additions and alterations)	..	..	..	..	..	..	..	..	
10. Old Buildings	35,304	..	..	..	..	..	..	4·00	
TOTAL	3,52,870	..	103·46	47,356	..	19·00	..	8·00	

APPENDIX V

TABLE XIII

Staff Quarters

Type of Qtrs.	No. entitled	Existing Qtrs.	Sanctioned	Further required.	Pay scale
A1	1	1	..	..	Above Rs. 2,000
A	34	18 plus 3 old	13	..	Rs. 1,000—2,000
B	59	40	6	13	Rs. 600—1,150
C1	113	80	..	33	Rs. 350—850
C	273	15 plus 9 old	34	73	Rs. 260—500
H	134	108 plus 13 old	..	13	Rs. 120—259
H1	224	88	50	86	Rs. 55—119
G	216 (60% of 360)	125 plus 120 old barracks	..	91	Below Rs. 55 (120 old barracks are to be demolished)
TOTAL	1,054	617 plus 145 old	103	309*	

---

*This does not include the requirement for temporary posts, 163 works charged posts for the engineering unit, military personnel of the National Cadet Corps and also the additional staff of the National Cadet Corps for the Air Wing.

APPENDIX V

TABLE XIV

Break-up of "Services and Amenities"

	Actual expenditure upto 1957-58 and expenditure to be incurred in 1958-59	Amount sanctioned for 1959-61.	Additional requirements
	(In lakhs)	(In lakhs)	(In lakhs)
1. Miscellaneous (*e.g.* Roads etc.)	Rs. ·50	Rs. 3·15	..
2. Dairy	..	..	Rs. 2·00
3. Hospital	..	Rs. ·60	Rs. 1.40
4. N.C.C.	..	..	Rs. 1·68
5. Gymkhana	..	..	Rs. 5·00
6. Water Supply	Rs. 5·65	Rs. 11·96	Rs. 6·35
7. Electrification	Rs. 30·39	Rs. 7·86	Rs. 1·75
8. Drainage	..	..	Rs. 5·00
9. Boundary Wall	..	..	Rs. 4·00
10. Security	..	Rs. 0·75	Rs. 1·25
TOTAL	Rs. 36·54	Rs. 24·32	Rs. 28·43

GMGIPND—TSWing—6 SRCA—31-5-61—500.